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# PATHOLOGICAL & OPERATIVE
# SURGERY,

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# ANATOMY.

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# PATHOLOGICAL & OPERATIVE SURGERY,

FOUNDED ON

## ANATOMY:

ILLUSTRATED BY
DRAWINGS OF DISEASED STRUCTURE,
AND
PLANS OF OPERATION.

BY
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AND LECTURER ON SURGERY.

IN THREE VOLUMES.
VOL. III.

EDINBURGH:
*Printed by A. Balfour and Co.*
FOR MACLACHLAN & STEWART, EDINBURGH, AND
BALDWIN, CRADOCK & JOY, LONDON.

1824.

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PLATE. 12

Fig. 1

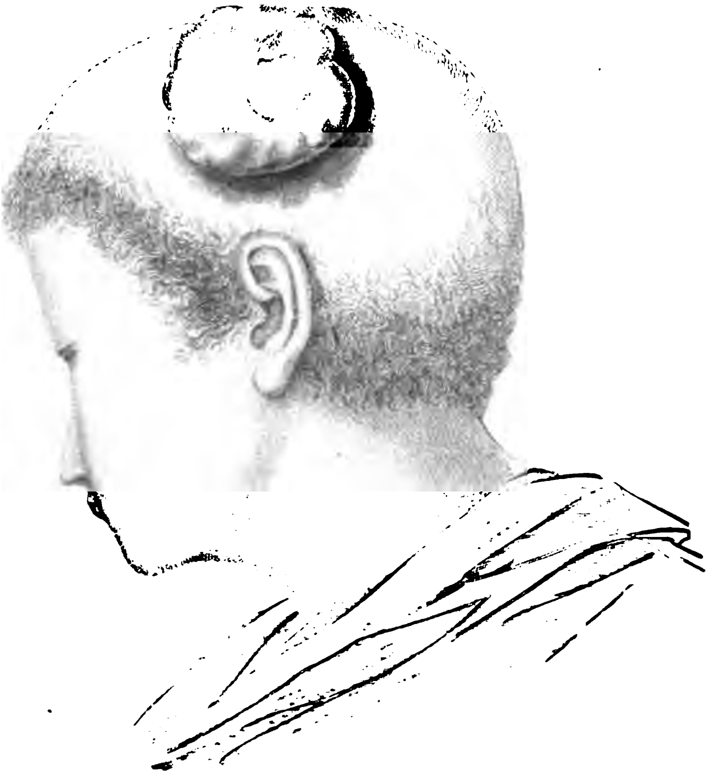
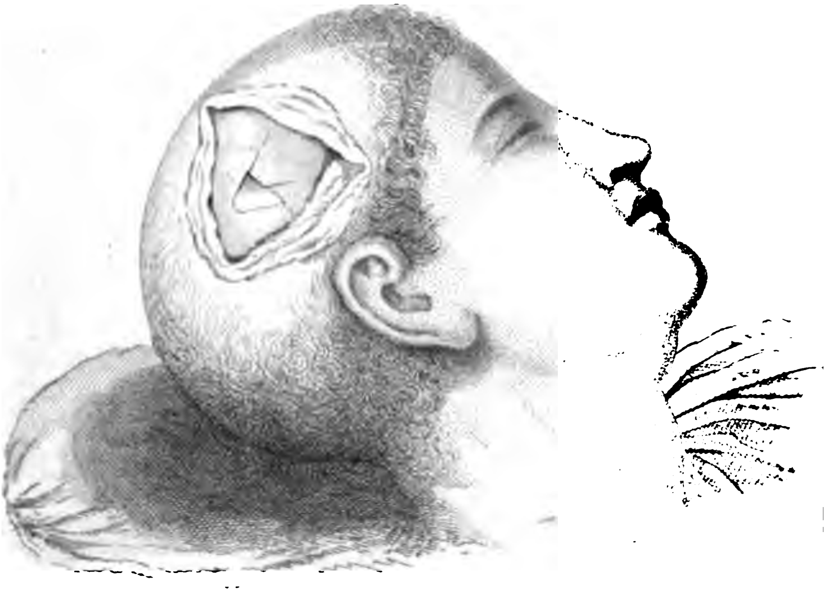


Fig. 2



# EXPLANATION

OF THE

# PLATES.

## PLATE XII.

Fig. 1st. is a representation of Fungus Cerebri, or protrusion of the brain, sometimes following the operation of the trepan, and arising in consequence of an opening in the dura mater.

Fig. 2d. gives a view of a fracture of the parietal bone. The fracture runs in various directions, and is observed to surround a piece of bone of a triangular form, one of the angles of which is seen depressed.

This drawing shows the appearance of the wound when the flaps are dissected back, and also illustrates the rule of surgery with regard to the place the trephine should be applied. When the bone is slightly depressed, as is here represented, the instrument should embrace a portion of it, while the central pin rests on the sound bone; but, when there is much depression, the instrument should be applied entirely to the sound bone, and in such a situation that the circle of the saw shall come in contact with the line of fracture.

## PLATE XIII.

This Plate contains representations of various instruments used in operations on the eye.

Fig. 1st. Scarpa's needle, used in the operation of couching. The needle delineated by Scarpa is more delicate, and much longer in the stem; but the one here represented is more manageable, and takes a better hold of the lens while it enters the eye with great facility.

Fig. 2d. The couching needle recommended by Mr. Hey of Leeds.

Fig. 3d. A spear-pointed needle, well adapted to the operation of division through the cornea. This needle is about an inch in length, and cuts on both sides at the point, to the extent of little more than a line, after which it should be round and increase in thickness as it approaches the handle, to prevent the escape of the aqueous humor.

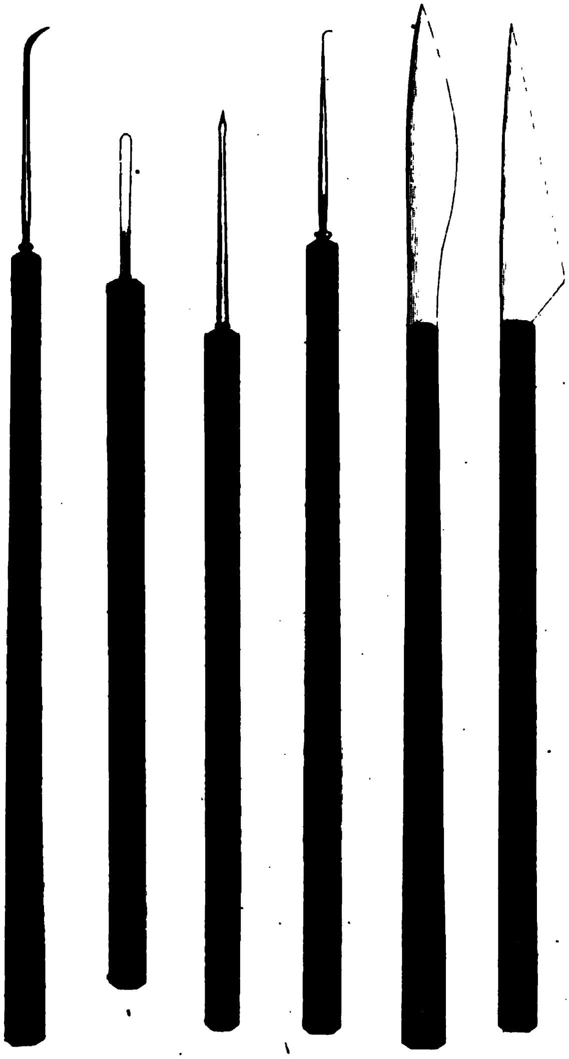
Fig. 4th. A small hook, adapted to delicate operations on the eye, such as bringing out the iris through an opening in the cornea, in the formation of an artificial pupil.

Fig. 5th. The knife used by Richter in the operation of extraction.

Fig. 6th. The knife used by Beer of Vienna in the same operation.

Either of these knives is preferable to Wenzel's knife, or that of Mr. Ware, as, when carried directly across the eye, it cuts its way out. Beer's is the one in general use.

## PLATE. 13



q. Aponeurotic fibres of the ilio-pubal ligament.
r. Situation of the femoral artery in the funnel.
s. Situation of femoral vein.
t. Vena saphena major, passing through an opening in the iliac portion of the fascia lata, which was reflected from the femoral vessels, and perforating the sheath of these vessels to enter the femoral vein.
u. Truncated superficial epigastric artery. The branches which it sent to the inguinal glands above the fascia lata, are reflected towards the pubis, along with the iliac portion of the fascia lata.
v. Reflected iliac artery.
w. Anterior crural nerve, rendered prominent by means of a probe passed under it.
x. Sartorius muscle.
y. Iliacus internus muscle.
z. The pubal extremity of the sheath of the femoral vessels, connected with which is a display of the relation of the different parts which unite to form the stricture in femoral hernia. 1, Ilio-pubal ligament embraced, along with the pubal horn of the funnel, by 2, The reflected tendons of the internal oblique and transversalis muscles. 3, Gimbernat's insertion of the external oblique, situated between the reflected tendons of the internal oblique and transversalis, and the superior horn of the falciform process of the fascia lata, which has been retained reflected, so as to exhibit an internal view of the openings at 4, Through which femoral hernia protrudes.

## PLATE 14

Fig. 1.

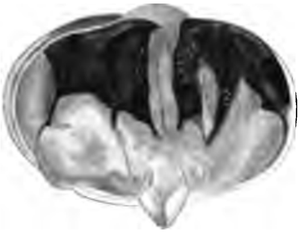
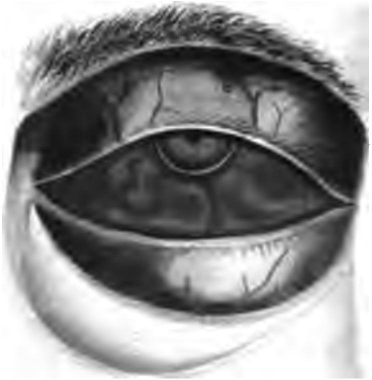


Fig 2



Engr.$^{d}$ by E. Mitchell.

## PLATE XIV.

Contains two representations of Fungus of the Eye, one a malignant, and the other a benign disease.

Fig. 1st. is a drawing of fungus hematodes in an eye which I extirpated in October last. The patient was a child two years old, and showed the first symptoms of the disease about four months before. At the time of the operation the eye-ball was slightly enlarged; the conjunctiva of the sclerotic raised, and of a soft fleshy appearance; the globe had an elastic feel when pressed on; the cornea was of a dark glossy appearance; pupil much dilated and irregular; and a body of a whitish colour could be distinctly seen behind the pupil. The eyelids were of a dark red colour, much swelled, and œdematous; and the sight was completely gone, but there was very little pain.

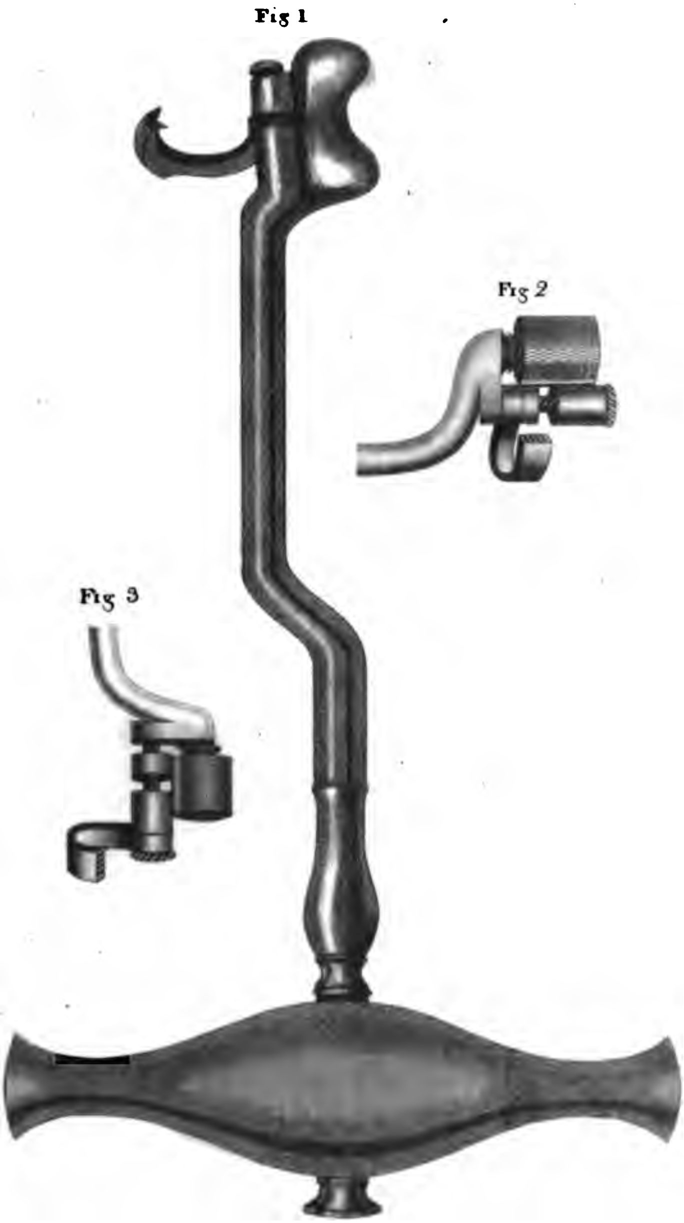
When the eye was laid open after its removal, it exhibited the appearance represented in the drawing. The optic nerve was of a yellow colour, and particularly vascular where it enters the eye. The situation of the vitreous humor was occupied by a lobulated tumor of a medullary appearance, and which seemed to be continued from the optic nerve. The tumor was very vascular in the centre, and occupied more than one-half of the cavity of the eye-ball. The vitreous humor was apparently pushed forwards, confounding the internal subdivisions, and disorganising the anterior parts of the eye. The lens was absorbed, and its place seemed to be occupied by a number of white chalky particles, about the sise of pin-heads.

Fig. 2d. is a representation of an enlarged eye in a woman sixty-two years of age, whom I am at present attending with Mr. Thomson. The disease commenced two years and a half ago, and the eye-ball, by slow degrees, has attained its present size. It now protrudes considerably from the socket, the conjunctiva is of a dark red colour, has a fleshy appearance, and the eye feels firm when pressed on. The eyelids are of a purple colour, streaked with enlarged veins, and so much swollen as nearly to cover the eye. There is no great increase of sensibility, and she complains rather of stiffness, and uneasiness from the distension, than of pain.

The disease seems to be of a benign nature, and resident in the conjunctiva, or cellular substance which connects it to the sclerotica. There is no opacity of the cornea, or of the humors, or diseased state of the retina and optic nerve; and, when she pushes up the eye-lid with her finger, she sees objects distinctly. The affected eye has been weakly since the time she had the measles, when a child; has been often the seat of inflammation; and the present disease was consequent on an attack of ophthalmia.

It may be worth while to observe, that before the eye was affected, there appeared on the cheek of that side an enlarged lymphatic gland, of the size of a walnut, but without pain. Shortly after another gland swelled on the opposite cheek; but the gland of the diseased side has disappeared within the last six weeks.

## PLATE 15.



## PLATE XV.

This Plate contains representations of the most approved forms of the common Tooth Key.

Fig. 1st. Mr. Hardy's Key with a double bolster. By the construction of the instrument, no resistance is given to the tooth to be extracted; the power is increased; and, from the pressure being divided upon two healthy points, there is both less pain and less danger of breaking the tooth.

Fig. 2d. Mr. Fox's improvement on the common key. The claw is here placed before the bolster, by which the counter pressure is removed from the tooth to be extracted, when this is required.

Fig. 3d. Mr. Spence's key, with the claw placed beyond the bolster, particularly well adapted to the extraction of the Dentes Sapientiæ.

*The Reader is requested to correct with the pen the following*

## ERRATA.

Page 60. line 9, insert a comma after sclerotica, and delete the comma after iris.

Page 71, line 5. Instead of " are" read is."

Page 284, line 25. Instead of " behind" read " beyond."

Page 285, line 28. Instead of " before" read " beyond."

# A
# SYSTEM
# OF
# PATHOLOGICAL & OPERATIVE
# SURGERY.

## CHAP. XIII.

## INJURIES OF THE HEAD.

In no department of our profession have surgeons been more divided in their opinions, or more unsettled in their practice, than in that of injuries of the head. If we trace the history of this subject, we shall find that neither the signs of danger have been distinctly enumerated, nor the motives which call for operation accurately defined. The greatest surgeons have taken only partial views, and have pursued a very indiscriminate line of practice. Le Dran, conceiving that fracture of the cranium must be followed either by extravasation, or such an injury of the dura mater as would give rise to suppuration, trephined in the most trifling case of fissure; Pott had recourse to an operation in "seven cases out of ten, of simple undepressed fracture," as a preventive of the dangers which he dreaded, "the inflammation and suppuration of the dura mater;" and Hey of Leeds, confining his observations principally to the injury done to the bone, inculcated the application of the trepan in every case where the cranium was fractured, and without reference to the brain; while Desault, from observing in the Hotel Dieu many wonderful recoveries in injuries of the head, had such confidence in the powers of nature, as to refrain from operation even when the brain was oppressed, and the patient was lying in a state of stupor.

The treatment of injuries of the head has undergone a complete revolution within the last thirty years. Platner was among the first who denied the necessity for operation in the majority of cases. His doctrine has since been established by the experience of Abernethy and J. Bell. Our practice in this department has unquestionably been greatly improved since the introduction of cold applications to the head, free bleeding, with other means of depletion, and a more sparing use of the trepan.

## GENERAL REMARKS ON THE ANATOMY OF THE HEAD.

Every practitioner and student of surgery must be supposed conversant with the number of the bones of the cranium, the sutures by which they are joined, and the names and relative situation of the investing membranes of the brain; but for the right understanding of injuries of the head, it is necessary to take a philosophical view of this subject; and, as the foundation of all true practice, I would direct attention to the following points. 1st, To the great size of the arteries of the scalp, and the density of its cellular substance. 2d, To the manner in which the tendon of the occipito frontalis muscle is spread over all the upper part of the skull, and to its intimate connexion with the integuments and periosteum. 3d, To the vascularity of the integuments and bone, and to the unity of circulation betwixt them and the skull and dura mater. 4th, To the connexion of the dura mater with the skull and with the brain. And, lastly, to the extent of the secreting surfaces of the brain.

1*st*, The integuments of the head are very vascular, and its cellular substance is very dense when compared with the cellular substance in other parts of the body. The scalp is supplied with large vessels, the temporal and occipital arteries being of great size, running up the sides and back part of the head, and inosculating freely with the same vessels on the opposite side. They are situated in the cellular substance, immediately under the skin, and external to the tendon of the occipito-frontalis. From their great size, wounds of the scalp, and the removal of tumours from this part, are frequently attended with profuse bleeding, and the slightest blow produces an effusion of blood. When blood is effused under the skin, from external injury in other parts of the body, the ecchymosis, in consequence of the looseness of the cellular texture, is diffused; but on the head, from the density of the same structure, it is always very limited, and forms a circumscribed tumor. It is therefore owing to the great size of the vessels of the scalp, and the density of its cellular substance, that blows upon the head are immediately followed by tumours, which, from the hardness of their base, and the softness of their centre, are apt to mislead the young surgeon, and to be mistaken for depressions of the skull.

*2d*, The occipito-frontalis muscle consists of two fleshy bellies, which cover the occiput and forehead, with a broad intermediate thin tendon covering the whole upper part of the head. This tendon is connected by a very vascular cellular substance, both with the skin and periosteum, but more intimately with the skin; and, from the nature of its connexion, and the manner in which it is spread over the bone, injuries apparently slight are sometimes followed by alarming symptoms. This is particularly the case in punctured wounds.

*3d*, All the bones of the body are very vascular, but particularly those of the skull, and its vessels are of great size. Independently of the smaller vessels, which are supplied by a thick and very vascular periosteum, numerous and large arteries, coming from the integuments, enter the skull in various places; and on its internal surface those arteries which have been named arteries of the dura mater perforate the bone in all directions. They run along the surface of the dura mater, with which they seem to have but little connexion, and they terminate in the bone, which is highly vascular. From the unity of circulation betwixt the integuments, skull, and dura mater, the death of the bone is uniformly followed by a separation of its external and internal coverings; while the detachment of one or other of these coverings, to any extent, affects the health, and sometimes even destroys the life of the bone.

*4th*, To understand the consequences of the separation of the dura mater from the skull, and the effects that the diseases of this membrane produce upon the brain, it is necessary to have correct notions of its connexions with these parts. The dura mater consists of two lamellæ; the external is rough and cellular, is firmly attached to the bone, and performs the office of a periosteum; the internal is a serous membrane; on its inner surface it is smooth and shining, and has a

It has been imagined that one chief use of the sutures is, to limit the extent of fractures, and by breaking the chain of communication, to confine the fracture to the bone struck: but I believe the opinion has arisen rather from theoretical than practical views. In the adult cranium, the sutures lock into each other, and the pieces composing it are so firmly united, as to constitute as it were but one bone. Every collection of surgical cases abounds with facts which contradict the assertion, that the sutures afford a protection against the extension of fractures; and every experienced surgeon must know how wide this opinion is from the truth. The extent of the fracture must depend upon the resistance and the force applied. We daily see fractures traversing the sutures in all directions, and even extending down to the basis of the skull. I have known a blow inflicted by the tiller of a boat produce a fracture of the left parietal bone, which ran forwards through the coronal suture, down to the orbit, and backwards through the lambdoidal suture, extending to the basis of the skull; although there was no wound, bruise, nor discoloration of the integuments, these having been protected by the hat; and I have preserved in my collection specimens which also show that the sutures afford little protection against the extent of fractures. Indeed the bones are so completely joined in the adult skull, that fractures not only extend across the sutures, but take place at a distance from where the injury is inflicted. A blow upon the occiput has fractured the frontal bone; the orbitary processes have been broken from a stroke upon the upper part of the forehead; and a violent injury inflicted on the crown of the head, has made the cranium yield at its basis. This species of injury is what has been called a counter fissure.

Fractures of the cranium vary in many respects, but chiefly with regard to their form and to their relative position, when compared with the superficies of the skull. Sometimes the fracture runs in a straight line, and there is no depression; at other times it runs in various directions, and is more or less of a stellated form. Sometimes the fractured portion is depressed below the natural superficies, and when this is the case, the portion of bone is sometimes so loose that it can be easily removed; while at other times the edge of the depressed bone passes under the sound cranium, and is so wedged in as to be firmly fixed.

Although much has been written on fractures of the cranium, particularly by the older writers, these fractures themselves, considered abstractedly, have no influence on our practice. We never think of trephining on account of a fracture of the skull, unless the patient at the same time labours under symptoms of compressed brain. Even when there exists a fracture with depression, we do not trepan unless there are superadded to the depression evident marks of compression. The French Academy were fond of the operation of trepan, had recourse to it in the slightest case of fracture, and always cut away large portions of the skull; which was a fundamental error in the practice also of Pott, Gooch, B. Bell, Lassus, and other celebrated surgeons. In Berengarius, in the Memoirs of the Royal Academy of Surgery, in Marchetti, Turner, Platner, Hill, Desault, Abernethy, in short, in the works of every practical surgeon, cases are recorded of portions of the cranium being fractured and depressed, where, although no operation was performed, the patients recovered.

When the skull is fractured, the brain is no doubt more apt to be compressed than when there is no fracture. In a fracture even without depression, the blood-vessels of the dura mater may be ruptured, by which a quantity of blood will be effused betwixt that membrane and the bone, so as gradually to separate them; in which case, the compression will increase in proportion as the blood is effused, and the membrane separated; while, in fractures with depression, the cavity of the cranium will be decreased, and hence the brain will be compressed. Still the symptoms of compression may not exist to such a degree in either case, as to require the application of the trephine; and besides, where the symptoms of compression are slight, they always soon disappear, because the brain gradually accommodates itself to the increased pressure. It indeed frequently happens, when the fracture is situated in the parietal bone, which is the most common seat of fracture, because the most exposed part of the head, that the middle artery of the dura mater is ruptured, a quantity of blood is poured out betwixt this membrane and the bone, and the symptoms of compression are strongly marked; but in all these cases it is to relieve the brain, and not on account of the fracture, that we operate.

Even when there is a depression, if the fracture be unattended with symptoms of compressed brain, we consider the injury in the same light as we do that of a fractured bone in any other part of the body, and we know that the action of the vessels will unite and consolidate the broken portions of bone, as in other fractures. When the skull is cut with a sword, there is seldom any danger; it is only when the bone is fractured by a violent blow, as from a bludgeon, brickbat, or any heavy body, or by a fall from a horse, that there is danger; and the danger arises, not from the fracture of the bone, but from the injury done to the brain. Even where there is effused blood, if the fracture is wide, there may be no necessity for the trephine, as the blood will escape through the line of fracture. In children I have seen the bone depressed to a considerable extent by falls, and still no symptoms followed to warrant the application of the trepan. In many cases of depressed skull, the bone has never been raised to its former level, but the brain has gradually accommodated itself to the diminished cranium, and the boys have grown up to manhood possessing every mental and corporeal faculty, and retaining such hollows in the skull as would contain a table-spoonful of fluid.

Our motives for trephining are, to give exit to matter formed in consequence of inflammation; to remove a portion of bone destroyed by disease; to relieve the brain from compression, arising from extravasation of blood or depressed portions of bone; and to allow us to pick out spicula of bone irritating the brain or its membranes. Of these motives, the least imperative are depressions of the cranium, because the compression which they produce is always partial, seldom extensive, and the brain in general soon accommodates itself to the diminished cranium. But the sharp spicula of a depressed bone, irritating the dura mater, are very apt to induce inflammation; and it is from inflammation of the brain that the chief danger of fracture of the skull arises. This may be excited either directly by the depressed bone, or subsequently by the bone becoming carious, and inducing slow inflammation and consequent suppuration.

The chief care of the surgeon being therefore to obviate inflammation, when a man receives a fracture of the skull, or a violent contusion on the head, and no symptoms exist to warrant the application of the trepan, or indicating concussion or commotion of the brain, he should be repeatedly and largely blooded, confined to bed, briskly purged, and kept on a low diet, while light, noise, and all kinds of excitement, must be rigorously avoided. If, notwithstanding this treatment, the inflammation continues to increase, the whole scalp must be shaved, and cold applications be constantly used, which act most powerfully in subduing increased action within the head; and, at the same time, a large blister should be applied to the nape of the neck.

Notwithstanding the employment of these prudent and necessary measures, it sometimes happens that the inflammation continues to spread rapidly, till at length matter is formed under the cranium, denoted by cold shivering, and the other changes enumerated at page 413, volume i. As soon as this happens, the trephine should be instantly applied, as the only chance the patient has; but until this change is distinctly marked, no operation should be performed. The great error in Mr. Pott's practice was his having recourse to the operation of trephining as a preventive of the ill consequences which might arise from the inflammation and suppuration of the dura mater; while in fact, by removing any portion of the cranium, and tearing up the connexions which subsist betwixt the bone and that membrane, the mischief was greatly increased, and the inflammation propagated over the surfaces and cavities of the brain.

## COMPRESSION OF THE BRAIN.

THE great danger in injuries of the head arises from the affection of the brain, and this organ may suffer either immediately in consequence of the injury, or from a diseased action induced at some distance of time. The first of these proceeds from compression or concussion, or from both; while the second is always the consequence of inflammation.

Compression of the brain, proceeding from external injury, may arise from a depressed portion of bone, from an extravasation of blood, and from the formation of matter in consequence of inflammation. In the first of these cases, the symptoms which indicate this state of the brain occur immediately after the injury; in the second instance, some time elapses before they appear, and they become more distinctly marked in proportion as the blood is effused from the ruptured vessels; and, in the third case, it is many days after receiving the injury that the compression takes place, because the formation of the matter is always preceded by inflammation, and, although the brain becomes compressed when the suppuration is extensive, still in this case the patient never dies purely from the compression, but rather from the inflammation, ulceration, and general derangement of the functions of the brain.

When a man falls from a height, or receives a violent blow on his head from a brickbat, bludgeon, or heavy weight, if the force is so great as to beat in a portion of the skull, and thereby compress and disorder the functions of the brain, the symptoms of compression are immediate; but if such a force has been applied as only to rupture a blood vessel, whether from fracture or otherwise, he is at first stunned, gradually regains some degree of intelligence, then complains of pain of head, dimness of sight, sickness at stomach, inability to walk or stand, and general confusion. But the cause continuing, and operating with increasing violence, he gradually grows insensible; the pulse becomes slow; he is attacked with hemiplegia, or one side of the body becomes paralytic; the pupil is dilated, and does not contract even when a lighted candle is presented; there is a general muscular relaxation, and loss of voluntary motion; the breathing is stertorous; the sphincter muscles of the rectum and bladder are paralyzed, and he passes his urine and fœces involuntarily. If the compression be slight he vomits; but if the pressure on the brain be considerable, there is no sickness or vomiting, because the stomach partakes of the state of torpor arising from the general diminishing irritability. These symptoms are more distinctly and strongly marked when there is an effusion of blood, than when there is only a depressed portion of bone, because a depressed bone acts partially, whereas an effusion of blood produces a general compression, with a gradual extinction of the energy of the brain, and consequently of the powers of life.

When the brain is much compressed, the free circulation of the blood through this organ is obstructed, the effect of which is diminished nervous energy. The heart, therefore, becomes languid in its actions, and the blood is not propelled with vigour over the system. At the same time that the circulation is languid, the breathing is oppressed, not only because this function has a close and manifest sympathy or correspondence with the circulation, but because there is a relaxed state, and consequent loss of action in the muscles performing respiration. The relaxation of the velum pendulum palati and muscles of the larynx and pharynx, prevents the free inhalation of the air into the trachea, and gives rise to the stertor in the breathing.

In cases of extravasation within the head, it is generally imagined either that the blood is effused from the rupture of a vessel in the substance of the brain, or, where the blood is above the dura mater, that it is thrown out from the middle artery of that membrane, by reason of this vessel being burst by the blow, or torn by a fracture of the bone, and that in consequence the dura mater is gradually separated from the bone as the blood is effused. This may no doubt sometimes happen; but there is every reason to believe, that in cases arising from external injury, where the blood is situated immediately under the bone, it is most commonly effused from small vessels; and that, instead of the blood being poured out by one distinct vessel, and separating the membrane from the bone in proportion as it is effused, the dura mater has first been separated from the bone by the blow, and that, in consequence of the separation, a number of minute vessels are torn from which the blood proceeds. This view of the case will account for the slowness with which we frequently observe the symptoms of compression follow an injury of the head, in some cases not even taking place till several days have elapsed. That the dura mater may be separated by a shock or fall, we have several well attested instances in the Memoirs of the Royal Academy of Surgery, and in the German Ephemerides; and in Mr. John Bell's Principles of Surgery will be found many apposite remarks on them.

This separation of the dura mater may terminate in four different ways: 1*st*, There may take place such an effusion of blood from the minute vessels, as completely to compress the brain, and, unless removed by operation, produce death. 2*d*, The effusion may derange the functions of the sensorium for a time only, and be at length absorbed, when the dura mater will regain its attachment to the skull, in the same manner as it does when the extravasation is removed by the trepan. 3*d*, The separation of the dura mater may affect the vitality of the bone, and in this or some other manner excite inflammation, and terminate in suppuration. And, 4*th*, The separation of this membrane may give rise to fungous tumours, which will through time destroy the bone, and appear externally.*

There is another affection of the brain arising from external injury, and which is very apt to be confounded with compression, or which may occur at the same time. It has been termed commotion or concussion. It arises from a violent shock communicated to the tender substance of the brain, and has been observed to happen in falls where the head has not been struck. The symptoms are nearly the same as those arising from compression, and the one is very apt to be mistaken for the other even by skilful surgeons; but, as the treatment is widely different, it would be very desirable to ascertain, if possible, the pathognomonic symptoms characterising each. In concussion, it is said that the extremities are cold, that there is in general no stertorous breathing, and that the pulse most commonly intermits. All this may be true in some cases, but I apprehend we can draw no determinate conclusion from these observations, unless conjoined with other circumstances. If I were called to a patient labouring under the symptoms enumerated as attendant on compression, and perceived by the introduction of my finger through a wound in the scalp, that the bone was depressed, I should immediately and naturally conclude that he laboured under compressed brain, which might arise partly from depressed bone, and partly from extravasated blood. If I perceived a fracture of the cranium with this train of symptoms, I should draw the same conclusion, and ascribe the state of the patient to pressure on the brain from effused blood. If, on the other hand, I perceived no depressed portion of bone, or no fracture, or if there was no wound or bruise of the scalp to direct me to the seat of the injury, I should feel at a loss whether to ascribe the state of the patient purely to compression, or to concussion, or to both. I have known surgeons of eminence debating such a case in consultation; some urging, from day to day, the application of the trepan, and others prudently resisting, but while their deliberations were going on the patient got well. There is one circumstance, however, which may be of use to us in determining in a case of this nature. If a patient, after receiving an injury, is immediately stunned, but in a short time begins to revive, gradually recovering some degree of sense, and again relapses into insensibility, we may ascribe his state to compression, which arises from the blood being slowly poured out from the ruptured vessels, whereas the symptoms arising from concussion are immediate. This remark, first made by Petit, has been much insisted on by the French surgeons, and has been copied by every succeeding writer.

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* That the dura mater may be separated from the bone by a blow, giving rise to effusion of blood, is proved by a very simple experiment. Let the head of a subject be struck a smart blow with a wooden mallet, and then injected with coloured size from the carotid arteries. When the skull cap is removed, a portion of the size will be found effused betwixt the dura mater and bone at the part struck, representing the manner in which the brain is compressed from an extravasation of blood. I have frequently tried this experiment, and was first directed to it from reading Shaw's Manual of Anatomy,—a work of great use to students, and well worthy the attention of the young surgeon, not only as containing clear descriptions of the parts, but good practical views and illustrations.

Compression and concussion may exist at the same time, and, although the symptoms of compression may not be so strongly marked as to warrant the application of the trephine, the concussion may lead to such derangement as may terminate in death; in short, there may be such a complication of symptoms, that the surgeon hardly knows how to act.

In cases of extravasation, the blood is most commonly effused betwixt the dura mater and the bone; but it is sometimes situated under the dura mater, and in this case, when the trepan has been applied, that membrane feels tense; the brain does not heave, but the dura mater rises up through the trepan hole, appearing of a dark blue colour. The blood may also be effused at the basis of the brain, in its substance, or within the ventricles. When the blood is situated betwixt the dura mater and the bone, it is removed, after operation, in three ways: part of it we immediately remove with our fingers, or with a probe covered with lint; part of it, by its exposure to the air, becomes deliquescent, and flows out of its own accord; and part of it is absorbed. When the blood is situated under the dura mater, we are desired to puncture that membrane with a lancet; but, in this case, the blood, meeting with little resistance, is not only extensively diffused over the superior part, but readily descends to the basis, and is so involved in the furrows on the surface of the brain, that it is removed with difficulty. A part of it may no doubt be discharged by becoming serous from exposure to the air; nevertheless a patient in these circumstances very seldom recovers; the blood is poured out from the vessels of the brain; the breach does not heal, but the part inflames; the inflammation terminates in suppuration; and the patient dies of abscess of the brain. Where the blood is effused into the substance of the brain itself, or into the ventricles, it is evident that no operation can be of service.

From the consideration of what has been said on the subject of compression of the brain, I apprehend that the operation of trepan is decidedly called for in the two following circumstances. 1*st*, When the symptoms of compression are distinctly marked, and where we find, either through a wound in the scalp, or after it has been divided by an incision, a portion of bone depressed. 2*d*, When the symptoms of compression are strongly marked, and when we perceive, either by dividing the scalp or by a wound, a fracture, and more especially when this fracture is situated across the track of the middle artery of the dura mater.

When there is no wound or bruise of the scalp, no pain manifested on pressure, or fracture discovered after incision, and yet the patient labours under symptoms of compression of the brain, it becomes a question whether the trepan should be applied or not. Some writers recommend it to be applied in the course of the middle arteries of the dura mater, as blood is more likely to be effused in that situation than in any other; but as the compression might readily arise from the rupture of internal vessels, in which case no relief could be obtained from trepanning, I am of opinion that no operation should be performed unless the surgeon is directed to the seat of the injury by some external mark. In cases where the symptoms of compression are well marked, it would on many occasions be very desirable to ascertain whether the dura mater was separated from the skull at that part where the injury was inflicted, or whether the blood was most likely effused into the substance of the brain. On this subject Mr. Abernethy has made a most valuable observation, viz. " that the bone situated over a separated dura mater will not be found to bleed," or at least not "with the same freedom and celerity as it does when the dura mater remains connected with it internally."* But although this remark of Mr. Abernethy's may be justified by an extensive practice, and may generally hold good, still we must recollect that the bones of the skull are so supported by an internal system of blood vessels, that the circulation is perfect even when both the dura mater and periosteum are detached; and in such circumstances the bone might bleed when scraped. The vascularity of the skull, indeed, is so great, that when a portion of it has been deprived of its integuments by laceration, when it has at the same time been depressed by fracture, and then raised by the levator, so as to be separated from the dura mater, still it lives and regains its adhesion both with that membrane and with the integuments. This is a practical fact which the surgeon should never lose sight of.

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* Abernethy's Surgical Works, vol. ii. p. 47.

When the dura mater is separated from the skull, it is natural to conclude that although the bone may live, the circulation will not be so perfect in it as when that membrane adheres; and from the unity of circulation betwixt the dura mater and the pericranium being destroyed, it is evident that the separation of the former will be soon followed by the separation of the latter. I therefore believe that when the dura mater is separated from the skull by an effusion of blood, the pericranium will be separated from the corresponding portion entirely, or at least will adhere less firmly to it than when there is no internal separation.

Where the compression is slight, or where the symptoms are not so strongly marked as to warrant the application of the trepan, the best practice is to bleed, to purge, to apply blisters to the neck, and cold applications to the scalp; all which means tend to prevent inflammation, and to promote absorption.

## CONCUSSION OF THE BRAIN.

In compression, the brain is affected through the medium of the circulation; but concussion is imagined to be an affection of the substance of the cerebrum itself, in consequence of external injury. From a shock or fall its component parts are rudely shaken or displaced, and the injury is immediately followed by a long continued stupor and general insensibility, which either terminate in death, or give rise to a set of symptoms afterwards to be enumerated. Although many surgical writers ascribe concussion to the pulpy matter of the brain being rudely shaken, or to its parts being in some measure displaced, and consider it entirely as a nervous disease, it is manifest that if the brain is thus shaken, there must be a rupture of vessels, effusion, and consequent compression. I would, therefore, consider compression and concussion nearly the same disease. But as compression from external injury arises either from a depressed portion of bone, or extravasation of blood, an operation is required to remove the pressure; whereas in concussion, the effusion is in the substance of the brain, and necessarily more general; its effects are instantaneous, and we have no motive for operation, because no operation can relieve. If in concussion the effusion is extensive, and so great as to overpower and diminish the energy of the brain, from which it is unable to relieve itself, the patient will die; but if the fluid can be absorbed, he for a time only remains in a comatose state, from which gradually recovering, either he regains his mental and corporeal faculties, or there succeeds an increased action of the vessels, and consequent inflammation. It is this state of excitement which we have chiefly to dread after concussion.

Sometimes a patient recovers in a very short time from the effects of concussion, and that so effectually as to experience no inconvenience; at other times he remains long comatose; and the brain sometimes suffers so much from the injury, that he never completely regains the powers either of body or mind. The cooper of his Majesty's ship Glatton, while in the hold, was knocked down by the breast-piece of a 68 pound carronade falling from the main deck and lighting upon his head; he instantly became comatose; his pulse was slow and feeble, but did not intermit; his breathing was without stertor; and his extremities were deadly cold. He remained in this state betwixt five and six weeks, and then began gradually to recover; he could not see distinctly for a length of time, but observed greenish spots before his eyes; and although he began to walk about, he was so feeble and so stupid, that he was invalided from the hospital on the third of July, having met with the injury on the twenty-sixth of January preceding. Boyer relates a case of a child who, from the fall of a screen on the head, remained four days in a comatose state, with no other signs of life than those of respiration and circulation. It then recovered, but was stupid and could not articulate a word, although it spoke very well before. It continued in this state for many months, after which it began to pronounce the words *oui* and *non*, and by degrees completely regained the power of speech.*

Systematic writers have enumerated, with some degree of confidence, one set of symptoms as characteristic of compression, and another as indicative of concussion; but little reliance can be placed on them, and it will frequently be impossible for the most experienced surgeon to say what the nature of the injury is. I have seen many cases of pure concussion where there was no intermission in the pulse; and the stertorous breathing, which is supposed to be peculiar to a compressed state of the brain, is often absent when there is an extensive extravasation of blood; while this symptom not unfrequently presents itself in concussion. I lately dissected, in the Royal Infirmary of Edinburgh, the brain of a female who died of an injury of the head, in consequence of falling down a stair; and, although there was an effusion of blood under the dura mater so extensive as to cover the whole anterior and middle lobes of the left hemisphere of the brain, and forming a cake three quarters of an inch in thickness in its deepest and central part, there was not present during the five days she was in the hospital the least stertor in the breathing.* The

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* Boyer, Traité de Maladies Chirurgicales, tome v. p. 93.

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* While this sheet is passing through the press, I am afforded an opportunity of stating another case in illustration of the uncertainty of the symptoms indicative of compression of the brain. I this day examined the head of a young man on whom I performed the operation of trepan three days ago. On the 27th of July, he fell in a quarry from a height of about thirty feet, and was wounded on the left side of the head, near the coronal suture. There was a distinct fissure in the frontal bone; but no insensibility, dilatation of the pupils, stertor in the breathing, or paralysis. The only marks of affection of the brain were occasional vomiting, and a slight degree of drowsiness; but by rest, bleeding, and free evacuation of the bowels, these symptoms went off, so that by the 31st, four days after the accident, he appeared to have completely recovered from the immediate effects of the injury.

This young man continued well for ten or twelve days, when he was attacked with pain of head, accompanied by a full and quick pulse, with other febrile symptoms. The lips of the wound separated; in its immediate vicinity there was great tenderness of the scalp when pressed on, and the bone was felt bare. These symptoms indicated inflammation of the dura mater, which, notwithstanding cold applications to the head, large and repeated bleedings, with other means of depletion, terminated in the formation of matter, on account of which I applied the trephine on the 15th of August. The dura mater was found separated, and a very small quantity of pus was discharged; but the operation afforded no relief, and the patient died three days after.

Upon dissection, a great portion of the frontal bone appeared to have been dead, from which the dura mater was separated; the surface of the membrane at this place was sloughy, symptoms enumerated by authors are so fallacious, and the subject so obscure, that an acute observer, and one of the first surgeons of the age, has declared, that compression and concussion may be accompanied by the same marks, and that no train of symptoms, when taken by themselves, can ever indicate in a positive manner the precise nature of the injury.[*]

Mr. Abernethy has with great propriety divided the symptoms attendant on concussion into three stages.[†] The first is a state of insensibility and derangement of the animal functions, immediately following the accident; the second stage is the

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and was inflamed throughout. Under the dura mater was found a large quantity of pus, covering all the upper part of the left hemisphere of the brain; and the fracture was observed to extend downwards to the basis of the skull, running close to, and parallel with, the coronal suture.

The inflammation and suppuration of the dura mater were natural consequences of the injury; but the remarkable feature in the case is, that, independently of what I have now stated, there were found about four ounces of coagulated blood lying betwixt the dura mater and the frontal bone. The blood rested upon its left orbitary plate, and extended upwards above the eyebrow, to within an inch and a half of the coronal suture; the orbitary plate of the frontal bone was half uncovered, and the anterior lobe of the left side so deeply depressed, that it was reduced nearly one-third in size. This blood was no doubt effused at the time of receiving the injury; yet there were no symptoms which could lead us to suspect that the brain was so extensively compressed.

[*] See Œuvres Chirurgicales de Desault, par Bichat, tome ii. p. 25, 28.

[†] Abernethy's Surgical Works, vol. ii. p. 83.

return of sense and restoration of the bodily powers in a greater or less degree; and the third stage is increased vascular action, which is followed by increased excitement of the brain. The first stage is in general characterized by difficult respiration, but without stertor; slow and intermitting pulse; cold extremities; pale face; dilated pupil; stupor; and a general insensibility to the operation of external agents. If this stage continues long, the patient dies, because the structure of the brain is so far destroyed as to render it unable to perform its functions and exert its influence over the system. But it most commonly happens that after the patient has remained for some time in this state, the extremities, and indeed the whole body, grow warm; the respiration becomes easier; the pulse is quicker and more regular; the pupil begins to contract, and the patient feels uneasy when the eye is exposed to the light; the stupor considerably abates; the patient becomes alive to the impressions of external agents, and is peevish when touched or spoken to. This, then, constitutes the second stage of concussion; but now the vascular action becomes more and more increased, and gives rise to the third stage, which is pure inflammation of the brain, and which more imperiously demands the interposition of the medical attendant. It is characterized by an increased degree of heat; a full and quick pulse, rising to 120 or 130 in a minute; full and flushed countenance; contracted pupil; inflamed eye, unable to bear the light; shocking pain of the head; and very frequently delirium.

If we look into the best writers, we shall find that there prevails a great diversity of opinion with regard to the treatment of concussion; and there is no point of practice on which surgeons have been more divided. Broomfield and Benjamin Bell recommend stimulants; the former opium, and the latter wine; while Pott and Boyer uniformly inculcate the propriety of bleeding; indeed the latter writer carries this practice of bleeding to a length unknown in this country.*

This diversity of opinion seems to have arisen from surgeons having taken but a limited view of this subject. They have directed their attention to one point, and not fully considered the series of actions consequent upon concussion. It is evident that immediately after the injury, while the powers of life are languid and depressed, copious bleeding might kill the patient; while, after the system has recovered itself, and the vascular actions have become strong, no practice could be more proper. Again, stimulants may be the fittest remedies in the stage of depression, while, during the increased action, nothing could be more injurious than the exhibition of opium and wine.

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* "Au moment donc où l'on est appelé auprès d'une personne qui a fait une chute dans laquelle la tête a porté, ou qui a reçu un coup sur cette partie, et qui éprouve les symptomes de la commotion, on doit faire un large saignée du bras, et y revenir plusieurs fois dans les vingt quatre heures. Si les accidens persévèrent, on ouvre une veine du pied et même la jugulaire, on applique en même temps des sangsues aux tempes. Il est impossible de rien fixer sur la quantité de sang que l'on doit tiner dans ce cas. On peut seulement assurer qu'il est peu de maladies qui exigent de plus grandes et de plus fréquentes saignées que le coups qui ont ébranle fortement le cerveau."

The value of Mr. Abernethy's observations consists in leading us to a more correct practice. We have sketched out three distinct stages of concussion, and the great point to be determined is the mode of treatment applicable to each of them. The first stage, which immediately follows the injury, and which is the state of diminished nervous energy, must be treated with the utmost caution. I apprehend that we should not bleed; while, at the same time, we should be cautious how we administer stimuli. If we bleed to any extent, we kill the patient by farther diminishing the influence of the brain: and if we unsparingly pour in stimuli, we are in danger of accelerating and increasing the inflammatory stage. I conceive that the best method of treating the first stage of concussion is to do very little. We have only to keep the patient quiet, and to unload the bowels by cathartic glysters. If we take any active measures, it should be to purge and to blister, which may tend to increase the absorption of any effused fluid.

In the second stage, which is the return of feeling and of motion, and an increasing sensibility of the sensorium, the utmost care should be used, as it is very apt to terminate in the third stage, or inflammation of the brain. The patient should therefore be kept in a dark room, free from noise, and perfectly quiet. Particular attention should be paid to the state of the bowels and of the skin. The former must be kept free by laxatives and glysters, and the latter moist by antimonials. All spirituous and fermented liquors must be abstained from, and the diet must be low. If the diseased action should not now terminate, but run into the third stage, which is inflammation of the brain, there is but one opinion with regard to the practice to be pursued. The patient should be repeatedly bled, both locally and generally, according to the force and quickness of the circulation. The head should be shaved, if this has not been already done; although I believe it to be a good rule in all injuries of this nature to shave the head immediately after the accident, both for the sake of a minute examination, and for the administration of remedies. As soon as the head is shaved, cloths dipped in cold solutions should be applied; a large blister should be laid on the back of the head and nape of the neck; and an irritation and discharge kept up by means of issue ointment. The patient must be briskly purged, while he is allowed to take nothing stronger than water; and a free perspiration should be kept up by means of antimonials, which are very powerful remedies in inflammation of the great cavities. They act in two ways, both by causing a greater flow of blood to the external and more superficial parts of the body, and by lessening the force of the circulation by the nausea they excite.

## INFLAMMATION OF THE MEMBRANES OF THE BRAIN, AND ITS CONSEQUENCES; SUPPURATION AND EFFUSION.

While compression and concussion are the immediate consequences of external injury, and are apt to be so confounded with each other as to perplex and mislead the surgeon, the symptoms which denote inflammation can present themselves only at some distance of time, and, to a careful observer, are quite characteristic of the state of the brain. In no part of the animal body is the contrast betwixt the progress, symptoms, and terminations of inflammation, so striking as in the membranes of the brain. There is a manifest distinction betwixt inflammation of the dura and pia mater, both in its symptoms and termination. When the dura mater inflames, the early symptoms are obscure; the inflammation is slow in its progress; the action is limited and long confined to that part of the membrane in the immediate vicinity of the injury; the intellect is not early affected; the inflammation terminates in the formation of matter; and the brain is often in extensive suppuration before any danger is suspected: whereas from the great vascularity of the pia mater, the symptoms of inflammation in it are violent, and the progress of the disease rapid; from its extensive and close connexion with the brain, the inflammation is diffuse, and the cerebral substance is involved; hence the functions of the brain are early disturbed, the patient becomes furiously delirious; and, from the extent of the secreting surface and delicacy of the membrane, the inflammation terminates in general effusion.

The inflammations of the dura and pia mater should be carefully compared and contrasted; because their dissimilar terminations necessarily require a different line of practice. The former generally arises from an injury of the scalp or the skull, and falls under the management of the surgeon; while the latter more particularly belongs to the province of the physician, although it not unfrequently presents itself to the surgeon as a consequence of concussion.

Inflammation of the dura mater arises from local irritation, as fracture or contusion of the cranium, and may succeed to the injury after a long period of time. When it succeeds to fracture or any direct irritation, the symptoms are more strongly marked, and the disease is quicker in its progress than when it arises from the separation of the dura mater, in consequence of the death of the bone. It sometimes happens after contusion or fracture, and even at such a distance of time as to have led to the belief he had entirely recovered, that the patient complains of loss of appetite, sickness at stomach, and confusion of head; his sleep is disturbed; the pulse becomes quick, full, and hard; the countenance is flushed; the skin hot; and the eyes inflamed, so that they cannot bear the light; and there is a girded pain in the head as if it were embraced by a cord, or as if the nightcap were too tight. The disease advancing, there succeed vomiting, vertigo, and increased confusion of head; but he answers questions distinctly, and there is no delirium except during the night, or at least this disordered state of the sensorium does not occur till the disease is far advanced.

The hardness of the pulse, the painful corded feeling in the head, and the absence of delirium in the early stage, are the characterising marks of the inflammation of the dura mater, and the symptoms are so well defined that the line of conduct to be pursued by the surgeon is plain and obvious. He should have recourse to free blood-letting, both local and general; cold solutions should be kept constantly applied to the head; a blister should be laid upon the nape of the neck; while the bowels are briskly moved by saline purges, or cathartic glysters; and for drink nothing should be allowed stronger than water.

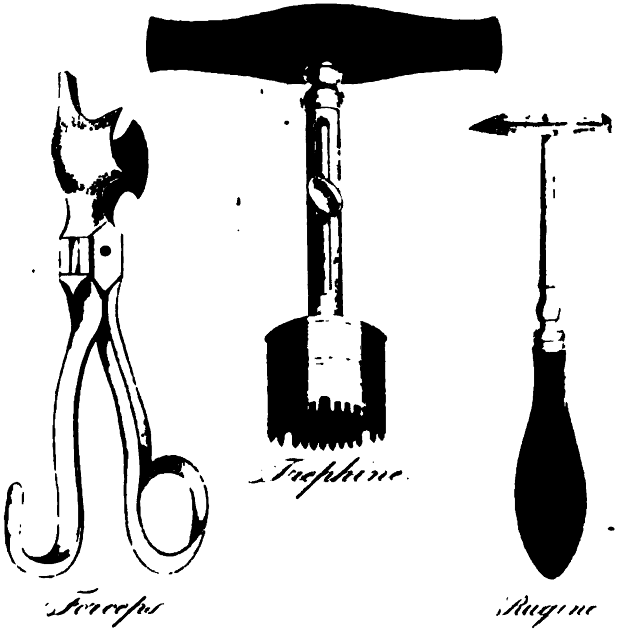
If no steps have been taken to subdue the inflammation, or if the means resorted to have proved ineffectual, the inflammatory symptoms are succeeded by frequent rigors. There is now great confusion of intellect; the pulse becomes soft and irregular; there is continual vomiting, with dilatation of the pupil; and the patient falls low, and dies, with all the symptoms of oppressed brain, such as coma, an involuntary evacuation of the fœces and urine, hemiplegia, and convulsions. Upon dissection, the dura mater is found separated from the bone to a greater or less extent, and its surface covered with purulent and glairy matter. Sometimes the membrane is of a dark yellow colour, and has a sloughy appearance, or is even perforated with holes. At other times pus is collected under it; and not unfrequently the ulceration and abscess extend into the substance of the brain. If the scalp be examined in the commencement of the inflammation, there will generally be found in the site of the injury pain on pressure, and, at a more advanced stage, a tender circumscribed puffy tumour; if there be any wound of the integuments, the sore loses its firmness and florid granulating appearance, turns pale, has a glazed appearance, becomes detached from the bone, and, instead of good pus, discharges a gleety and glutinous matter.

While the inflammatory symptoms are present, full and free depletion, both by the lancet and otherwise, is the means to be employed. But when the inflammatory action has terminated in suppuration, which is denoted by the rigors and symptoms of oppressed brain, the trepan is the only chance the patient has, and it should be instantly had recourse to: for though, from fracture of the cranium, from compression or concussion of the brain, a patient left to nature may recover, yet after suppuration of the dura mater, unless the bone exfoliates, or the trephine is applied, he will inevitably die.

Inflammation of the pia mater, as it falls under the care of the surgeon, may be produced by every kind of local injury, and presents itself as the third stage of concussion. When it occurs in the practice of the physician, it may be traced to all those causes which are capable of accelerating the circulation within the head; such as intemperance, violent and long continued exercise, particularly in the meridian of life, and under a vertical sun, the exciting passions, &c. The symptoms which characterise it, and the practice to be pursued, I have already detailed under the third stage of concussion; and I may now only remark, that when not subdued by blood-letting, and other means of depletion, it terminates in effusion, both into the ventricles and over the surfaces of the brain; then succeeds a state of compression which no operation can relieve, and which is characterised by vomiting, dilated pupil, slow pulse, torpor of the bowels, stupor, and palsy.

Inflammation of the membranes of the brain generally terminates in three ways. First, in resolution, when depletion has been early and vigorously employed; and this is the case in whichever of the membranes it is situated. Second, In effusion, when the inflammation is in the pia mater, a termination which often takes place in children, and forms the true hydrocephalus acutus. And, Third, In suppuration, when the inflammation is situated in the dura mater, and follows fracture or contusion.

Trepanning Instruments.



## OPERATION OF TREPHINE.

Our motives for applying the trephine have been already enumerated. It enables us to elevate depressed portions of bone; to give exit to extravasated blood; to give vent to matter formed in consequence of inflammation; and to allow us to extract spicula of bone or other substances. As this operation is dangerous in itself, the surgeon should be particularly careful to apply his trephine to the proper place, so as to preclude the necessity of a second perforation. A small opening in the cranium will give vent to matter, and extravasated blood can always be partly removed by the fingers or a probe, and partly washed out by tepid water; while the remainder, melting down by exposure, will flow out of its own accord. The only case, therefore, that commonly calls for the re-application of the instrument, is when a portion of depressed bone is so firmly wedged in that it cannot be elevated.

There are certain parts of the cranium in which the established rules of surgery forbid us from trephining. These parts are near the basis of the skull, from the numerous muscles and soft parts with which it is covered; the frontal sinus, because in this situation the teeth of the saw would have passed through one half of the inner table before it could have touched the other half; the centre of the forehead, as in some skulls the internal frontal ridge is very prominent, running far back towards the coronal suture, and before the section of this spine of bone could be completed, the dura mater would be wounded by the teeth of the saw; the middle of the occipital bone, from its irregularity in thickness; the anterior and lower angle of the parietal bone, because the trunk of the middle artery of the dura mater runs under it, incased in a groove of the bone; and, lastly, on any point in the course of the great longitudinal and lateral sinuses. But experience justifies us in saying, that we are deterred, more from the difficulty of operating in these situations, or from imaginary fears, than from any real danger. Near the basis of the skull, the soft parts can be readily dissected off; the skull may be safely perforated through the frontal sinuses, by substituting the smaller crown of a trephine for the larger, after the external table has been removed; the internal frontal ridge and the irregular spines of the occipital bone may be safely cut through by the convex saw of Mr. Hey, after the rest of the circle has been completed by the trephine; if the trunk of the middle artery of the dura mater should be wounded, the bleeding could be very easily suppressed by the pressure of a small bit of lint, or as the vessel runs on the external surface of the dura mater, a fine needle might be passed under it so as to secure it by ligature; indeed, where the surgeon was operating on account of extravasated blood, he could never run any risk of wounding this artery, as the dura mater would be separated, and the effused blood lie betwixt the artery and the teeth of the saw; and, lastly, with regard to the longitudinal and lateral sinuses, the cases of Sharp, Warner, and Pott show that any hemorrhage from the former can be easily suppressed by means of pressure with a bit of lint, and I have no doubt the same practice would prove equally efficient in wounds of the latter.

The instruments commonly enumerated for this operation are, 1st, A strong scalpel to divide the integuments: 2d, A raspatory or rugine to denude the bone of the pericranium, and to ascertain if the bone bleeds, which, as we formerly noticed, is considered as a mark by which we judge whether the dura mater adheres or is separated; but this instrument is not absolutely necessary in a trepan case, as a scalpel answers all its purposes: 3d, A perforator to make a small hole fit to receive the central pin of the trephine; there is also no particular necessity for this instrument, because the central pin makes a hole for itself: 4th, Trephines of different sizes: 5th, A small brush to clean the teeth of the saw from time to time: 6th, A cut quill, or small probe to ascertain the depth of the groove of the saw: 7th, Forceps to take out the piece of bone separated by the saw: 8th, A lenticular to smooth the edges of the trepan hole: 9th, Elevators of different forms and sizes to raise portions of depressed bone: and, 10th, Mr. Hey's saws, which are useful for removing portions of bone where the trephine is inadmissible, or where it would take away too large a piece.*

In commencing the operation of trephine, the integuments should be divided by a crucial incision, or by an incision in form of the letter T; or if there be any wound, the incision may be regulated by the form of it; but the surgeon should be careful to cut none of the integuments away, as after the operation the flaps should be laid down to cover the trepan hole. Mr. Pott and other eminent surgeons of his day always cut out a circular portion of the scalp, which they called the preliminary operation of scalping. This was a great error in Mr. Pott's practice, but was rather the fault of the surgery of the time in which he lived, than peculiar to him. When the flaps have been dissected back, a chief point to be determined, previously to the commencement of the perforation, is the place the trephine should be applied, according to the nature of the case. If a portion of bone is depressed, and at the same time not very firmly fixed, the instrument should be applied entirely to the sound cranium, but in such a situation as to bring the trepan hole in contact with the line of depression. If the depressed bone is firm, the instrument should be applied at that point which will most readily free it, and so as to include a portion of it, but the central pin should be fixed upon the sound part.* When there is a fracture without depression, the instrument should be applied in the line of fracture, where it is widest; and, when operating to give vent to matter, and the bone is carious, in the centre of the diseased portion. As soon as these preliminary points have been settled, the surgeon proceeds to denude the bone, either with the scalpel or raspatory, but he should be careful not to separate the pericranium farther than is absolutely necessary, as an extensive separation of this membrane, by depriving the bone of a great portion of its nourishing vessels, might lead it to exfoliate. Indeed, there seems to be no necessity for scraping the bone at all, as the pericranium can never impede the working of the trephine. The saw is now to be applied, with its central pin projecting beyond the teeth, and moved backwards and forwards by the turning of the hand, till such time as it has made a groove sufficient to maintain itself, when the central pin is to be withdrawn to prevent it wounding the brain. The surgeon thus by continuing to work the saw, cuts through the bone, and in doing so should proceed with the greatest caution, not trusting to the change of sound and bleeding when he arrives at the diploe, for the following reason: In very young skulls the diploe is not yet formed, and the bone is extremely thin; it becomes thicker in middle age; and again, in consequence of absorption, becomes thin in old age; besides, there is such a diversity in the thickness of skulls, that no reliance should be placed on the change of sound, or on bleeding during the operation. The surgeon should from time to time remove the instrument in order to clean the teeth of the saw with his brush, and to ascertain the depth of the groove by means of the quill or the probe. If he finds that the groove is deeper on one side than the other, he must, in working the saw, throw the pressure on the opposite side; and when he thinks the bone is nearly sawn through, he should occasionally remove the trephine, and with the forceps attempt to detach the circular piece of bone. This he will easily accomplish if it is at all loose, and thus prevent any injury to the dura mater. Any projecting points of bone must be smoothed off from the trephine hole by the lenticular.

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* Representations of the principal instruments used in trephining, will be found in the marginal plates at the beginning and end of this discourse on the operation of trephine. The instruments are represented about half their real size.

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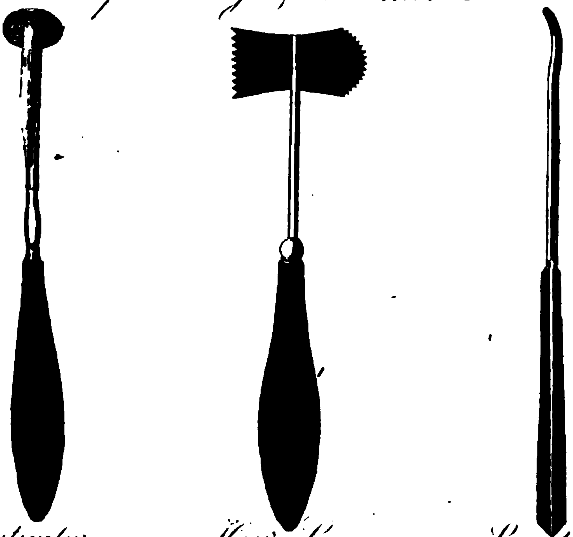
* See Plate xii. Fig. 2. for the form of the incision, for the representation of a fracture, and for the point for applying the trephine.

When the circular piece of bone has been removed, if the surgeon has been operating on account of depression, he should now introduce his levator under the depressed bone, and attempt to poise it up; and if much force is required to effect it, he should always use a fulcrum with the levator, so as to prevent any undue pressure on the opposite side of the trepan hole. When the bone is very firmly fixed, it will be preferable to reapply the trephine, rather than persevere in fruitless or dangerous efforts to raise it. When the surgeon has been operating to give vent to extravasated blood, if it is situated betwixt the dura mater and the bone, besides the tendency which the heaving of the brain has to throw it out, it may easily be removed by the fingers or probe, with the assistance of tepid water, and the membrane will yield to pressure; but if the blood is under the dura mater, this membrane will feel tense, be of a livid colour, and require to be punctured with a lancet. In this case, the blood from its extensive diffusion can never be completely removed, and the wound is attended with the utmost risk on account of the danger of protrusion of the brain. When operating on account of matter, little farther is required to be done, than to place the head in that posture which will allow the matter most easily to flow out. And with regard to the extraction of foreign bodies, I need hardly observe, that they must be removed by the fingers, or dressing forceps.

When the object of the operation has been accomplished, the flaps are to be laid down upon the trepan hole, and covered with a piece of oiled lint or simple dressing, securing all by a slight compress, and the couvre-chef bandage.


Trepanning Instruments.

## FUNGUS CEREBRI.*

When large portions of the cranium have been removed by operation, external injury, or exfoliation, the brain is deprived of its support, and, by the pulsation of its arteries, the dura mater is rubbed against the rough edges of the bone, by which it ulcerates, and the brain then protrudes. This protrusion from the cerebrum is more particularly apt to occur when the dura mater has been wounded by accident or design, and it may present itself under three different forms: It may consist either of disorganised pure cerebral matter; partly of cerebral matter and of coagulated blood; or be an organised mass. The first generally occurs immediately after the injury, and arises from the substance of the brain being wounded, and a portion of it being separated from the common mass. The second most commonly takes place some days after the injury, and seems to arise from the rupture of one or more blood-vessels a little below the surface of the brain, in consequence of which a portion of this viscus is mechanically raised through the opening in the dura mater, skull, and integuments. This protrusion is of a dark colour, and is at first covered by the pia mater; but, the internal hemorrhage continuing, the brain is still farther raised, this membrane then gives way, at length the brain yields, and the blood is effused upon the surface of the tumor. This is the protrusion of the brain described by Mr. Abernethy in his "Observations on Injuries of the Head," and of which he has given some well-marked cases. The third species of protrusion from the brain follows abscess, or ulceration of that organ, hence does not appear for many days, and is as completely organised as the fungi springing from other ulcers. This is the fungus cerebri properly so called, the form of the disease to which the reasonings of Mr. Charles Bell apply,* and which I mean at present to consider.

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* For a representation of fungus cerebri, see Plate XII. Fig. 1.

The fungus which arises from the brain shoots up with great rapidity, is of a greyish colour, and is generally about the size of a pigeon's egg; but, on some occasions, it is as large as a hen's egg, or a small orange. Its appearance is always preceded by an opening in the dura mater, and is always connected with ulceration of the brain. In fact, it seems to be formed precisely in the same manner, and to be as truly organised, as those fungous excrescences which arise from the surface of other ulcers. The suddenness of its appearance, and the rapidity of its growth, have been stated as objections to its organization; but we observe organised fungi to be as suddenly produced in ulceration of the penis, and in the disease called Fungus Hematodes; while the vascularity of the tumor, its diminished size after death, its capability of being injected from the brain, and its being acted on by caustics, may all be adduced as proofs of organization. I apprehend that the rapid growth of this tumor may be easily accounted for, from the softness and very vascular structure of the cerebrum.

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* See "A System of Operative Surgery," by Mr. Charles Bell, vol. i.

Fungus cerebri is a very dangerous disease, as marking deep ulceration and suppuration of the brain. The tumor protrudes through the trepan hole, or other vacant space in the cranium, and when it chokes up the opening so as to prevent the escape of the matter, is followed by stupor and paralysis. If vent is not given to the matter, there succeed complete coma, dilated pupils, slow pulse, and other symptoms of compressed brain; and, after death, the pia mater is found to be inflamed, the brain in the vicinity of the tumor is soft, pulpy, and in a state of suppuration, and the lateral ventricle of the diseased hemisphere generally full of pus.

It appears to me, that, in this disease, a chief part of the treatment should consist in securing a free exit for the pus, or serum, which may be lodged in the substance of the brain; therefore, when the tumor is large—when the opening in the skull is completely choked up by it—and more especially when the patient is in a comatose state, I conceive that the protrusion should be cut freely off. This practice may be repeated as often as the fungus becomes large, and the bad symptoms return. Any hemorrhage which may follow will soon cease of its own accord, or will be easily suppressed by such a degree of pressure as will not materially interfere with the animal or vital functions. The excision of the tumor has been practised in many cases with marked advantage. On some occasions the patient has torn it away; and when nature effects a cure, it seems to be by the fungus being grasped by the trepan-hole as tightly as if embraced by a ligature, in consequence of which it is detached, and falls off in pieces. When the fungus is violently torn off, or otherwise detached, it is often reproduced; while on other occasions this is not the case, the ulcerated surface immediately granulating, and as the granulations unite with others arising from the dura mater, bone, and integuments, the whole soon cicatrizes.

If the protrusion is small, and the opening in the skull not so completely filled up but that a discharge is allowed to the matter, I see no immediate cause for the interference of art, and would rather intrust the case to nature, taking care, at each dressing, to push the fungus aside, so as to permit the free evacuation of the matter. It has been recommended to employ compression, with a view to repress the fungus; but in all those cases which I have seen, no compression that could be employed with safety was able to effect it. If the compression was slight, it had no effect in keeping down the tumor; and when increased, it immediately affected the functions of the brain.

## FUNGOUS TUMORS OF THE DURA MATER.

The organic changes of internal parts are attended with such obscurity, that frequently before their nature can be ascertained, the disease has made so great a progress, and is attended with such a destruction of structure, as to render abortive all attempts to cure it. This is particularly the case with fungous excrescences arising from the dura mater. Before the tumor appears externally, there is an opening in the cranium, the bone is extensively diseased, and the parts within the head are in general in a state of suppuration. This disease is slow in its progress, and the first certain indication of its existence is a tumor of the scalp, which is of an indefinite size, sometimes only the bigness of a small walnut, at other times the size of a hen's egg, and on some occasions it has attained a much larger bulk. The tumor is soft and yielding, of the natural colour of the integuments, and has a distinct pulsation. From this latter circumstance, the disease has been frequently mistaken for hernia cerebri, or aneurism. Sometimes acute pain precedes the appearance of the swelling, and at other times there is no pain till the external tumor appears. Occasionally the disease is accompanied by stupor and other symptoms of an affection of the brain; there is only a slight giddiness at other times; and in several cases the patient has continued to walk about, neither pain, sickness, nor any constitutional derangement being present, which could lead to the belief that there existed so fatal a disease. From the appearance of the swelling, and more especially from the absence of any formidable symptom, it is apt to be mistaken for a simple tumor of the scalp, and to be considered of little moment. That the tumor however, is not merely confined to the integuments, but proceeds from within the skull, may be ascertained with a degree of certainty by the firmness of its base—by its pulsation—by its diminution when firmly pressed on—and by this compression being followed by convulsions, stupor, and other symptoms of oppressed brain.

Fungus of the dura mater occurs at all periods of life. It is sometimes produced by a blow or fall, but on other occasions it cannot be traced to any external injury. It is maintained by Mr. Louis,* who writes on this affection, and it has been generally imagined, that the disease commences in the dura mater, and that the bone is secondarily affected from pressure; but there is great reason for questioning this opinion. It appears to me that no tumor could be formed on the external surface of the dura mater, as long as that membrane maintained its vascular attachments with the bone; it is necessary that the healthy connexion should first be destroyed, and that a separation should take place. This separation of the dura mater may occur from direct blows, as we have explained under compression of the brain, or may arise in consequence of a diseased state of the bone. I think it more than probable that fungi of the dura mater most frequently arise from this latter cause, because they often take place when no direct injury has been inflicted, and may then be traced to the same constitutional affection which produces internal suppuration, or caries in the long bones; and that when they have originated in a blow, they will be more likely to induce a slow disease in the bone than to separate the dura mater. When the bones of the skull become diseased, whether from an internal or external cause, the dura mater separates from the internal table; and the irritation induced gives rise to a slow or chronic inflammation of this membrane; which becomes thickened, and shoots out a fungus. This grows into a tumor, forcing its way through the diseased bone, and raising the scalp. Upon dissection, the internal table of the skull is found to be more extensively diseased than the external, the fungous granulations are covered with pus, and they can be easily separated from the bone although they adhere firmly to the dura mater.

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* Mémoires de l'Académie Royale de Chirurgie, tome xiii. 12mo.

Fungous tumors arising from the dura mater may be accounted a fatal disease; but as soon as their existence is ascertained, the surgeon should make every attempt to remove them. A crucial incision should be made in the course of the tumor, and the flaps dissected back till such time as the fungus and the bone surrounding its base are completely uncovered. That portion of the skull in immediate contact must be removed by the trephine and Mr. Hey's saws, so as to expose the diseased surface. When this has been accomplished, the surgeon may remove the fungus with the knife, or, if it can be effected, by forcing it off by means of a firm spatula, after which the patient should be treated as in the case of the operation of trepan.

The greater number of cases operated on will undoubtedly die, and in many instances this termination will even be accelerated by the operation; but no other practice which affords the least chance of success is left for the surgeon to pursue.

# CHAP. XIV.

## DISEASES OF THE EYE.

### GENERAL REMARKS ON THE STRUCTURE OF THE EYE.

The eye is an organ consisting of a numerous complication of parts, very delicate in its structure, and very subject to disease. Some of its diseases may be traced to external injury, others occur spontaneously, and all are of less or more importance in proportion as they affect the appendages of the eye, or are situated in the globe itself. In our remarks on the anatomy of this organ, I shall make some observations, 1*st*, On the structure of the appendages of the eye; and 2*d*, On the ball of the eye itself; then I shall consider its diseases in the same order.

### I. APPENDAGES OF THE EYE.

1*st*, Eyelids.—The eyelids consist of the orbicularis muscle and common integuments; and that they might not press unduly upon the eye, there is interposed at their edges a semilunar cartilage, which lies betwixt the doubling of the skin, and keeps them extended and accurately applied to the eye. Each end of the cartilage, where it joins its fellow at the corners of the eye, is tied to the periosteum by a ligament. The upper eyelid is raised by the levator muscle, and both the eyelids are shut by the orbicularis. The semilunar cartilage is called the tarsus; the eyelashes, the hairs of the tarsus; and the ducts of the meibomian glands terminate on the tarsus where they pour out their mucus.

THE MEIBOMIAN GLANDS.—Upon the eversion of the eyelids, the meibomian glands are seen lying under the lining membrane close by the tarsus. They appear like small white lines running directly to the tarsus to empty themselves of a white unctuous matter, which is sometimes so changed in quality and increased in quantity, as to seal up the eyelids during the night. The meibomian glands are the seat of the stye, and are named after their discoverer Meibomius.

TUNICA CONJUNCTIVA.—To prevent foreign bodies getting into the orbit, to attach the eye to the socket, and to connect it with the eyelids, there is interposed an accessory coat, common to the eyelids and the eye. The skin which covers the eyelids is inflected so as to line them, and then passes off so as to be reflected over all the forepart of the eye. As this membrane joins the eye to the eyelids, it is called Tunica conjunctiva; and as it adheres at this place to the eye, it is called Tunica adnata. All that part of the eye seen from without the orbit is covered by the Tunica conjunctiva; and as this coat is a continuation of the common skin, it is very vascular, and is so liable to inflammation, that opthalmia is a very common disease. Where the skin covers the eyelid, it is of the common thickness; where it turns under the eyelid to line it, it becomes somewhat thinner; where it passes forwards over the ball of the eye, it is so thin that the expanding tendons of the muscles of the eye shine white through it,—hence this part is frequently named Tunica albuginea; and where it is continued over the cornea it is quite transparent. It has been denied that the conjunctiva covers the cornea, and from a superficial examination of the healthy eye, we might be led to imagine that it terminated at its edge; but we know that it does not. The membrane appears to be modified for its new place, is there transparent and invisible, and seems to be assimilated to the nature of the cornea. Its continuity is very manifest in disease. In incipient inflammation we can perceive red vessels passing from the white of the eye over the surface of the cornea; in violent opthalmia the cornea becomes obscured by red vessels; and in a more advanced stage of the disease there is thickening, abscess, and ulceration.

The conjunctiva does not adhere firmly to that coat of the eye with which it is in immediate contact, but is so loosely attached to the sclerotica, that in violent superficial inflammations blood is frequently effused betwixt the two coats, raising the conjunctiva so as to appear like a fleshy substance, and giving the cornea a flattened and sunk appearance. This is the case in purulent opthalmia.

LACHRYMAL GLAND.—One use of the conjunctiva is to prevent dust, and other foreign bodies, getting backwards to the bottom of the orbit, while, by its reflection over the ball of the eye, it forms a sort of gutter. In this gutter any foreign bodies which may be present in the eye are collected and swept away by the tears; for which purpose, the lachrymal gland is placed in the upper and outer part of the eye, a little way within the external canthus. The passage into the nose is at the lower and inner angle of the eye, so that the course for the tears, which wash across all the conjunctiva, is direct. For example, if smoke offend the eye, the irritation excites tears; or if a mote fall into it, the eyelids are instantly shut with spasmodic violence, the lachrymal gland is compressed, and the mote is carried down to the inner angle, where it is thrown out from the eye. The lachrymal gland is of a flat oval form, of the size of a small nutmeg, with five or six ducts, which pierce the conjunctiva, and open immediately within the upper eyelid towards the external canthus. It continually pours out the tears, which cause the glistening of the eye, and is particularly excited by any irritation.

LACHRYMAL DUCTS.—The lachrymal ducts are situated at the inner corner of the eye, and consist of two little tubes, which, like syphons, draw the tears continually. Their openings or puncta are placed upon the cartilaginous borders of the eyelids at their inner termination, one on the upper, the other on the lower eyelid. From their mouths being cartilaginous, they remain always open, but the tubes themselves are membranous. The upper duct runs in an oblique direction downwards and inwards, but the lower one horizontally. They soon meet each other, and are then expanded into a small bag called the lachrymal sac.

LACHRYMAL SAC.—The lachrymal sac is formed by the junction and dilatation of the lachrymal ducts, or at least the lachrymal ducts terminate in it. It is a membranous bag, situated within the orbit in the groove of the os unguis, and covered by the tendon of the orbicularis muscle. From its lower part passes a duct about half its diameter, which conveys the tears into the nose.

**NASAL DUCT.**—The nasal duct is continued down from the lower part of the lachrymal sac into the nose. It runs downwards and backwards in a groove, formed by the nasal process of the superior maxillary bone, and opens low in the nostril under the lower spongy bone.

**LACHRYMAL CARUNCLE AND SEMILUNAR VALVE.**—At the internal canthus of the eye, betwixt the eyelids, is situated a red granular body, called Caruncula lachrymalis, consisting of a number of follicles which secrete an unctuous matter, like that which is secreted by the meibomian glands. Attached to its base, is a red semilunar membrane, named Valvula semilunaris, which, when the eye is turned towards the temporal margin of the orbit, is distinctly seen of a crescentic form, and covering a part of the white of the eye.

This curious piece of mechanism may be considered as an apparatus for straining the tears. If the tears were to carry along with them dust or other foreign bodies into the tubes, there would be produced irritation and obstruction; but the caruncula and semilunar valve standing up, are so opposed, that when the tears are attracted by the puncta, the dust remains upon the projecting point, and is thus raised out of the eye.

The lachrymal gland sometimes becomes diseased, and requires to be extirpated; the puncta sometimes close, so that the tears are not received into the sac; and the nasal duct is sometimes so obstructed, that the tears are not transmitted into the nose, but form a tumor of the sac, and cause a watery eye. These are diseases to be afterwards considered.

## II. EYE BALL.

Although from recent investigations there is reason to believe the cornea to be of a different structure from the sclerotica and the iris, not a continuation of the external layer of the choroid coat, still these parts are so intimately connected, that the most simple way of describing the ball of the eye, and of conveying to the surgeon the clearest ideas of this connexion, is to consider it with Le Cat as consisting of the optic nerve and its coverings expanded within the orbit.

### *Coats of the Eye.*

1st, Tunica sclerotica.—The optic nerve, as it passes out from the skull, is covered by the dura and pia mater. The dura mater consists of two laminæ. The external attaches itself to the bone, lines the orbit, and forms for it a periosteum; while the internal and stronger layer gives form to the eye, and constitutes its strongest and outer coat. This latter is called the sclerotica, and is a tough and dense membrane, possessing little vascularity, and coinciding in its properties with the dura mater.

2d, TUNICA CHOROIDES.—The pia mater, a membrane of most exquisite vascularity, enters the orbit along with the optic nerve, and immediately expands to form the second, or choroid coat. This coat consists of two laminæ, highly vascular, and easily injected; its vessels form a sort of pile upon its inner surface, called the Tapetum of Ruysch, and they secrete an inky matter called Pigmentum nigrum, the use of which is to suffocate the superfluous rays of light, and thus enable a more distinct picture to be formed on the retina.

3d, THE RETINA.—The optic nerve itself, by its expansion, forms the third and inner coat, which is called the retina. This expansion is extremely delicate, of a grayish tint, and is the sentient part of the organ.

The sclerotica, choroides, and retina, constitute the proper coats of the eye; but its fore part and its internal subdivisions may be considered as formed by the same coats.

1st, CORNEA.—The sclerotic coat gives the general shape to the ball of the eye, but at the fore

## *Humors of the Eye.*

To fill up the coats, to keep the parts at a proper distance from each other, and at the same time to accomplish the optical purpose of concentrating the rays of light, and impinging them on the retina, so as to form a distinct picture, seem the reasons why the eye is filled with humors. These are three in number, the vitreous, the chrystalline lens, and the aqueous humor. In a healthy state, they are transparent, but in disease they increase in quantity, or become opaque; and this is so frequently the case with the crystalline lens, that it forms the subject of our chief operation on the eye.

1st, VITREOUS HUMOR.—The vitreous is the posterior and great humor of the eye; constitutes four-fifths of its bulk; is convex posteriorly, and concave anteriorly, where it receives the convex posterior surface of the crystalline lens. It is of the consistence of the white of an egg, and is intersected by a membrane, which contains it in many cells. This humor is called vitreous from its glassy appearance, and has a transparent coat or capsule, called hyoloidea, which is distinct from the proper coats of the eye, and which surrounds it and divides it by partitions into cells.

2d, CHRYSTALLINE LENS.—The chrystalline lens is the central humor of the eye, and is exactly of the form of those lenses which opticians use. Its posterior surface is a little more convex than its anterior, and it is lodged in the cavity on the forepart of the vitreous humor. The capsula hyoloidea, consisting of two lamellæ, splits, at the anterior part of the vitreous humor, so as to embrace and surround the lens, which is by this means so firmly retained in the cavity on the forepart of the vitreous humor, that it cannot be dislodged without rupturing its capsule. The lens is of various degrees of consistence at different periods of life. At birth it is a gelatinous fluid, and of a reddish colour; in the adult it is of a firmer texture, and perfectly transparent; and in old age it is more dense and of an amber colour. It has the name of chrystalline from its consistence and appearance, and of lens, from its shape and office of condensing the rays of light. When opaque, it constitutes the disease called the cataract, which we take out from the eye, or remove from the axis of vision, supplying its place by an artificial lens.

3d, AQUEOUS HUMOR.—As the iris could not move if it were oppressed by the weight of firm or solid parts, the fore part of the eye is distended by a transparent fluid, called the aqueous humor, in which the iris floats. The space betwixt the cornea and the iris is called the anterior chamber, and that betwixt the back part of the iris and the anterior surface of the lens, the posterior chamber of the aqueous humor. They communicate through the hole of the pupil, but there is a great disparity in the size of these two chambers. The anterior chamber is about one line and a half in breadth; while the posterior is not above one-sixth of that depth. This is a space quite inadequate to hold the lens. Indeed this compartment of the eye is so small, that the uvea or back of the iris almost touches the anterior surface of the lens; and when that humor becomes opaque and requires to be removed from the axis of vision, it must either be reclined backwards into the substance of the vitreous humor, depressed under that humor, or brought forward through the pupil into the anterior chamber. Here it may be allowed to remain for absorption, or it may be taken altogether from the eye, but it can never be contained in the posterior chamber. The aqueous humor is of the same limpidity and specific gravity as water, and the secretion is so quick, that when evacuated by accident or operation, it is renewed in twenty-four hours.

## SECTION I.

## DISEASES OF THE APPENDAGES OF THE EYE.

The appendages of the eye are subject to a multiplicity of diseases. The most common of these may be arranged in the following order. 1st, Opthalmia; 2d, Psoropthalmia; 3d, Purulent opthalmia of infants; 4th, Hordeolum, or stye; 5th, Ptosis; 6th, Lagopthalmus, or hare eye; 7th, Ectropion; 8th, Entropion; 9th, Encysted tumors of the eyelids; 10th, Tumor of the Lachrymal gland; 11th, Fistula Lachrymalis; 12th, Pterygium; and, 13th, Encanthis. All these complaints occasionally present themselves to the surgeon; but the most frequent in their occurrence are opthalmia and fistula lachrymalis.

### I. OPTHALMIA CONJUNCTIVÆ, OR EXTERNAL INFLAMMATION OF THE EYE.

Inflammation, whether external or deep seated, is the most common disease with which the eye and its appendages are attacked. It accompanies in a greater or less degree all its most ordinary affections, and always precedes those changes of structure in the organ which give rise to permanent loss of sight. All the coats of the eye are liable to be attacked with it, but more especially those which are most vascular, such as the iris, ciliary processes, the choroid coat, and the conjunctiva. The three former are the seat of internal inflammation, and the latter that of external or common opthalmia, the species of inflammation we have at present to consider.

In external or superficial opthalmia, all those symptoms which characterize inflammation are present, such as redness, increased heat, pain, and swelling. The three former manifest themselves immediately upon the commencement of the inflammation; and in the progress of the disease the fourth symptom appears, and is in some cases very conspicuous.

The acute and chronic states of inflammation are well exemplified in opthalmia. In its early stage there is great heat in the eye; a prickling pain, as if excited by the presence of sand; an inability to bear the light; if the eye is pressed upon, or attempted to be exposed, the pain is very acute; and there takes place an inordinate flow of tears. The surface of the conjunctiva is covered with red vessels, and although the heat is diffused over the whole eye, the pain is more acute, and the sensation of a foreign body more distinct at that point where the red vessels are most numerous. The inordinate flow of tears is a natural consequence of the increased irritability; but it sometimes happens, that during the violence of the inflammation, the lachrymal secretion is diminished, and the surface of the eye is dry. In this case the heat and pain are particularly distressing. If the inflammatory action is violent and long continued, blood is effused betwixt the sclerotica and conjunctiva, raising the latter in the form of a red fleshy substance, called chemosis; the inflammation at the same time extends to the cornea, and is apt to be followed by such opacity as partially or wholly obscures vision. When there are acute pain in the forehead darting through the orbit, tension of the eye-ball, great tenderness when pressed on, and total inability to bear the light, the inflammation has extended to the deep-seated parts of the eye, and, unless very active means are had recourse to, is apt to terminate in suppuration and complete destruction of the structure.

In the acute stage of external opthalmia, when the disease is slight, there is no constitutional affection; when severe, there is always an acceleration of the circulation, with other febrile symptoms; and I believe that this is uniformly the case when the deep-seated parts are affected.

After the inflammation has continued for some time, the febrile symptoms cease, the heat and prickling pain subside, the flow of tears is diminished, there takes place a glutinous secretion, and the eye is able to bear the light. The inflammation has now passed into the chronic stage, and the most marked feature of its existence is the increased redness of the conjunctiva. Although this membrane is now as vascular as in the early stage of the disease, its appearance is no indication of the violence of the pain, which depends entirely on the state of the inflammation. If it is in an acute state, although not extensive, there is great pain; if again, in the chronic stage, notwithstanding the conjunctiva be completely inflamed, there is very little pain.

The inflammation, when not very violent, is for some time confined to the conjunctiva covering the sclerotica and lining the eyelids. It then extends to this membrane covering the cornea, and red vessels can be distinctly traced upon its surface; but the sclerotica being interposed betwixt the conjunctiva and the deep-seated vascular coats of the eye, the inflammation is not readily communicated to them, and hence the eye is frequently inflamed for a length of time without being followed by loss of sight. When this consequence follows external opthalmia, it arises from ulceration or opacity of the cornea, the former being caused by the inflamed conjunctiva ulcerating, and the latter by the effusion of coagulating lymph under this coat, or betwixt the layers of the cornea; whereas, when blindness follows inflammation of the iris and other deep-seated vascular parts of the eye, it arises from closure of the pupil, internal suppuration, or a bursting of the cornea, adhesion, and consequent staphyloma.

The most common exciting causes of inflammation in the conjunctiva are exposure to cold, foreign bodies getting into the eye, as particles of sand or lime, and long continued application to minute objects, especially by candle light or the light of the fire. A variety of other circumstances are capable of producing it, but from whatever cause it originates, it seems to be essentially modified by the condition of the general system, whether the patient be in a state of health, or is affected with scrophula or syphilis. Sometimes only a part of the conjunctiva is inflamed, but when the inflammation is violent the whole coat is affected. The inflammation may be confined to one eye; but very frequently both eyes are inflamed at the same time, or are attacked in succession.

With regard to the two stages of opthalmia, we may remark that the sight is more in danger during the acute, but the most difficult of cure is the chronic.

## TREATMENT OF EXTERNAL OPTHALMIA.

THE conjunctiva must be regarded of the same nature as the mucous membranes; and, like them, is a continuation of the common skin. When inflamed, the same treatment is applicable to both structures. In the acute stage of opthalmia, all the remedies should be of an anodyne nature, and applied warm; while in the chronic stage they should be astringent and stimulating, and employed cold; but the great difficulty in the treatment of this disease consists in the due discrimination betwixt the two stages. If the surgeon has recourse to highly stimulating applications, such as the vinous tincture of opium, before the opthalmia has completely passed into the chronic stage, all the acute symptoms will be reproduced and the inflammation increased; whereas, stimulating washes and ointments are the only cure in the completely established chronic stage. The important point, therefore, which the surgeon has in view, is to ascertain the exact state of the inflammation, so that, by adapting his remedies to it, his practice may be at once rational and successful.

When the patient complains of heat, pain, and intolerance of light, the opthalmia is acute, and the best local treatment consists in fomenting with decoctions of poppy heads, warm solutions of the acetate of lead, or of opium, or even steaming the eye with warm water. At the same time, the bowels should be briskly moved by saline cathartics, the patient put upon a low diet, and confined to a dark room, with a shade so placed as to exclude the light; but the eye should not be bound up, as the inflammation is thereby increased both from the heat and the pressure. If the opthalmia is slight, these remedies will not fail soon to subdue it; but if the inflammation is severe, leeches must be applied to the temples and forehead, near to the eye, and the number should be much greater than what is generally employed. Instead of five or six, which can be productive of little service, especially in an adult, if bleeding is at all necessary, a dozen at least should be applied, and repeated till the activity of the inflammation is gone. At the same time, a blister should be placed behind the ear, or on the nape of the neck. If the pulse is quick, and there exists much febrile irritation, in addition to what we have recommended, it will be prudent to take blood from the general system, by opening either a vein in the arm, or the temporal artery, and, at the same time, to exhibit small doses of the tartarate of antimony, so as to keep up a perpetual nausea.

As soon as the eye is able to bear the light, the surgeon should endeavour to ascertain the state of the organ. If he perceives any large vessels running to the cornea, more especially if there is any opacity in that coat, these vessels should be repeatedly divided by a lancet, or the cataract knife; or, what is preferable, a portion of them may be entirely removed with the curved scissars and a small pair of forceps. This procedure will tend materially to preserve the sight, which is in great danger from the growing opacity.

When the febrile symptoms are gone, the heat and pain greatly diminished, and the eye in some measure able to bear the light, the activity of the inflammation is over, although the chronic stage is not yet completely established. All the applications should now be used cold, and should be slightly astringent, but not stimulating. One great error consists in having recourse to stimulating applications while any considerable irritability remains; on the other hand, if warm applications are long persisted in, we are in danger of inducing a vascular relaxation difficult to remove. In this intermediate stage, the best applications are cold watery solutions of opium, in the proportion of one scruple to six ounces of water, and filtered through blotting paper; or saturnine solutions, formed with five grains of the acetate of lead to four ounces of rose water. The eye, forehead, and temples, may also be occasionally laved with cold water, while the crumb of bread, soaked in a saturnine solution, or even in cold water, is applied to the eye, betwixt the folds of a piece of linen, during the night.

In proportion as the sensibility of the eye abates, and the disease passes into the chronic stage, we should have recourse to washes and ointments still more astringent, and of a stimulating nature; and when the opthalmia has become purely chronic, the best collyrium is a cold solution of the sulphate of zinc, in the proportion of one grain of the salt to an ounce of water, increased in strength as the eye can bear it. With this solution the eye should be bathed frequently during the day, and at bed time there should be interposed betwixt the edges of the eyelids, by means of a hair pencil, a little of the Ungt. Hydr. Praecip. Alb. that is, Janin's ointment; the Ungt. Oxid. Hydr. Nitrat. or Mr. Ware's ointment; or the Ungt. Oxid. Hydr. R. which is Baron Wenzel's ointment. These ointments should be reduced in strength, by adding an equal quantity of axunge, and they may be afterwards rendered stronger as the eye becomes habituated to them. The best application of the three, I believe to be the Ungt. Oxid. Hydr. R. and an ointment of a proper strength may be formed by levigating in a glass mortar eight grains of the red oxide of mercury, with a few drops of olive oil, till such time as all the rough particles are destroyed, and then adding two drachms of axunge. By bathing the eyes repeatedly with the solution of the sulphate of zinc during the day, and applying the ointment of the red oxide of mercury at bed time, chronic opthalmia will in general soon be cured; but should this not be the case, the cure may be materially assisted by putting into the eye every morning two or three drops of the vinous tincture of opium. This, instead of being dropped directly into the eye, may, when the patient is laid upon his back, be poured into the corner of the eyelids, at the internal angle, when it will be speedily diffused over its surface.

It must be recollected, that, if the opthalmia has been produced by the introduction of a foreign body into the eye, this, if still present, should be removed preparatory to all treatment; and that, if the disease seems to be kept up by the presence of scrophula or syphilis, these affections must be combatted by general remedies, in conjunction with the local treatment; the former by bark, the preparations of iron, sea-bathing, absorbent and alkaline medicines, in combination with bitters; and the latter by a well-regulated course of mercury.

## PSOROPTHALMIA, OR ULCERATED INFLAMMATION OF THE EDGES OF THE EYELIDS.

The name of psoropthalmia, or opthalmia tarsi, has been given to an inflammation and ulceration of the mouths of the meibomian ducts. The disease is attended with a vitiated secretion from the glands, and a thickening of the tarsal edges of the eyelids. This discharge is of such a thick and viscid nature as to seal up the eyelids during the night, and form incrustations on their edges. When the incrustations are removed, numerous ulcerations are perceived; the edges of the eyelids are inflamed and excoriated; the inflammation and excoriation sometimes extend over the whole skin covering the eyelid, and on some occasions even to the cheek. When the disease has been of long continuance, the eyelid becomes gradually everted, the lining membrane, as well as the meibomian glands and their ducts, is thickened and inflamed, and the inflammation, in some cases, spreads to the conjunctiva covering the ball of the eye. This disease is always attended with a heat and itching; the patient cannot refrain from rubbing the eyelids, which increases the heat and irritation; and partly from the ulcerations, and partly from the removal of the incrustations formed by the vitiated discharge from the glands, the tarsus is deprived of its hairs.

Psoropthalmia often follows smallpox and measles, and seems in many cases to be connected with a scrofulous habit. It may present itself either in an acute or chronic form; but those cases which fall under the care of the surgeon are generally of a chronic nature.

## TREATMENT OF PSOROPTHALMIA.

This inflammation is so difficult to cure, that its existence has been commonly ascribed to a scrofulous, or otherwise diseased state of the constitution; and there is no doubt but that this is sometimes the case, although, in general, a local treatment is sufficient to remove it. When the inflammation is acute, warm solutions of opium and the acetate of lead are the preferable remedies, till such time as the irritability subsides; but when the disease is chronic, which is most frequently the case, the best treatment consists in bathing the eye-lids repeatedly during the day with a solution of the sulphate of zinc, adapted to the sensibility of the parts, and applying to the inflamed and ulcerated surfaces, at bed time, by means of a hair pencil, a little of the Ungt. Oxid. Hydr. R. of the same strength recommended for the opthalmia conjunctivæ. I believe that this plan of treatment will, in general, be found efficacious; but when the disease has been of long continuance, it is sometimes very difficult to cure; and, in this case, a collyrium, made by dissolving one grain of the oxymuriate of mercury in six ounces of water, may sometimes be employed with advantage, while we substitute an ointment of the subacetate of copper for that of the red oxide of mercury, formed in the proportion of five grains of the salt to two drachms of axunge or simple ointment. It will be advisable, at the same time, to give the patient every night, at bed time, one of the Pilul. Sub-Mur. Hydr. Comp. or Plummer's pills, or from a drachm to two drachms of the Sulph. Potass. c. Sulphur. Whether these preparations act merely on the bowels, or produce any more important change in the system, I am unable to determine; but I think I have seen them attended with a good effect in some cases of this disease.

## PURULENT OPTHALMIA OF NEW-BORN INFANTS.

This disease generally appears from the fourth to the tenth or twelfth day after birth, and is more peculiar to the conjunctiva of the eyelids than to that of the ball of the eye. There is first perceived a redness and thickening of the edges of the eyelids, more conspicuous at the inner angle, with a discharge of unctuous matter, which seals up the eyelids, and an inability to bear the light. The eyelids soon swell, and there takes place a discharge, of a greenish-yellow colour, which in a short time becomes so profuse as to run over the cheek, exciting inflammation and excoriation. The conjunctiva palpebrarum, as in gonorrhœal opthalmia, is thickened, has a red granular appearance, and looks like the villous coat of the protruded intestinum rectum in children. This inflamed and thickened state of the membrane sometimes extends to the conjunctiva sclerotica, and then the cornea has a sunk appearance; but in the majority of cases it is confined to the lining membrane of the eyelids. When the imflammation extends to the eye-ball, the disease is particularly dangerous, as it is very apt to terminate in loss of sight. This happens sometimes from the cornea becoming opaque, or ulcerating, and sometimes from its sloughing, or bursting; an event necessarily followed by escape of the humors and sinking of the eye, or by protrusion of the iris, adhesion, and staphyloma. Independently of the thickened and fleshy state of the conjunctiva, and the puriform discharge, one of the most marked characters of this opthalmia is the swollen state of the eyelids. Their external surface is redder than usual, and, when the child cries, they puff up and become of a bluish or rather livid colour, as if distended with blood. This is particularly the case with the upper eyelid, and during the crying and exertion of the child, or when the surgeon attempts to open the eyelids, to ascertain the state of the organ, their edges are everted, the swollen and vascular conjunctiva then comes into view, and the matter is discharged profusely over the cheek.

In the early stage of purulent opthalmia we find great restlessness, increased heat of skin, and other febrile symptoms; but these shortly subside, and the opthalmia then assumes more of the chronic form. As the disease occurs more frequently in the lower ranks of life, and as these classes are neither so attentive to health, nor so easily alarmed, as the higher and middling orders of society, it generally happens that the acute or febrile stage is gone before the disease falls under the care of the medical attendant; and hence this stage is so apt to escape detection, that it has not been very accurately described by some writers on this subject.

In the progress of this species of opthalmia the febrile symptoms first cease, and the child becomes less restless; then the swelling of the eyelids subsides, and the puriform discharge is diminished. After a time the secretion loses the purulent appearance, and is succeeded by a discharge of mucus, with an increased flow of tears. The child is now able to look up, particularly in an obscure light, when it is found, that, according to the violence of the disease, the eye is either perfect, the cornea partially opaque or ulcerated, or the structure so changed that the sight is irrecoverably lost.

Both eyes are in general affected at the same time, or, at least, if the disease commences in one eye, it is soon followed by a similar affection of the other; and although we have said that it is most commonly confined to the conjunctiva lining the eyelids, still it often extends to that covering the eye-ball. It is only in this latter case that the sight is endangered.

The purulent opthalmia of new-born infants has been generally ascribed to cold, impure air, and want of cleanliness; but in all the cases which have come under my observation, the mother laboured under a discharge from the vagina at the time of parturition; and I believe this will be found, upon minute investigation, to be always the case. Some writers, no doubt, admit that the disease may sometimes be traced to a discharge from the vagina of the mother, but this discharge they conceive to be leucorrhœa. In answer to this I may remark, that leucorrhœa is a very frequent disease in this country, and at the time of parturition many women are afflicted with it, whereas purulent opthalmia is rare. Again, in Sweden and Holland, although a great proportion of the women are afflicted with this discharge, this affection of the eyes is no more common in these than in other countries: besides, leucorrhœa is seldom if ever infectious; at least it does not appear that the disease is often communicated to the male, notwithstanding its frequency of occurrence.

I have, in cases where it was little suspected, been able to trace this disease to the infection of gonorrhœa; and from all the observations which

I have been able to make, I can view the purulent opthalmia of new-born infants in no other light than as a gonorrhœal opthalmia.

## TREATMEMT OF THE PURULENT OPTHALMIA OF NEW-BORN INFANTS.

In the treatment of purulent opthalmia, a variety of remedies have been recommended; and without attending to the acute and chronic stages of the disease, a chief aim of the majority of surgeons is to lessen the discharge. To effect this end they have at once had recourse to astringents, and even to stimulant applications. Mr. Wathen first used the Aq. Camphorat. of Bates's Dispensatory; and this preparation is particularly recommended by Mr. Ware in all stages of the disease, in the commencement as well as after it has subsisted for some time; but it requires little consideration to perceive, that the Aq. Camphorat. and other stimulants must be quite destructive in the early or acute stage of purulent opthalmia; while, in the chronic stage there is no application so beneficial or so speedy in effecting a cure. It is by not attending to the exact state of the inflammation that the opinions of writers are so discordant, both with regard to the Aq. Camphor. and other remedies.

I apprehend that the scientific treatment of purulent opthalmia, as well as of all the other inflammations of the eye, consists in appropriating our remedies to the different states of the disease. In the commencement of the inflammation, and more especially while it is attended by general restlessness, heat of skin, and other febrile symptoms, a decided antiphlogistic treatment should be pursued. The child should be kept cool and in a dark room; the bowels should be freely opened; and, as topical applications, recourse should be had to warm anodyne fomentations, such as warm solutions of opium, and the acetate of lead, or even warm water. Independently of fomenting externally, the medicines should be injected by means of a syringe, carefully passed betwixt the eyelids at the external canthus, so that the injection may wash along the whole surface of the conjunctiva; and this should be frequently repeated in the course of the twenty-four hours. The more effectually to subdue the vascular action, one or two leeches may be applied to the temples, or blood may be taken directly from the inside of the eyelids by scarification with a lancet. As the abstraction of blood by means of leeches is not so much under control in infancy as in adults, and as the bleeding might be so profuse as to induce great exhaustion in weakly infants, I conceive the preferable practice to consist in taking the blood directly from the seat of the disease, which is easily effected by the surgeon separating the eyelids with one hand, while with the other he draws the edge of the lancet once or twice across the thickened and inflamed conjunctiva. This will be immediately brought into view by the separation of the eyelids, and should be kept exposed as long as the blood continues to flow, the evacuation of which may be greatly assisted by bathing with warm milk and water. The abstraction of a small quantity of blood has a powerful effect in lessening vascular action in infancy, and the operation may be repeated each successive day, as often as it is required. The good effects of the bleeding may be greatly promoted by the application of a blister to the back part of the occiput.

When the febrile symptoms abate, when the discharge is fully established, and has perhaps continued for a few days, the lotions and injections of the solutions of opium, and the acetate of lead, should be used cold. In a farther progress towards the chronic stage, solutions of alum, or of the sulphate of zinc, in the proportion of two grains of the former, and one of the latter, to an ounce of water, may be substituted for the cold opiate or saturnine solutions; and these may be gradually strengthened by the addition of a little more alum, or sulphate of zinc, or a little of the vinum opii may be added. Lastly, when the chronic stage is completely established, the Aq. Camphorata of Bates's Dispensatory is an admirable remedy. It is made by mixing four ounces of the sulphate of copper, and four ounces of Armenian bole, with an ounce of camphor. One ounce of these made into a powder, is to be thrown into four pounds of boiling water, then removed from the fire, and allowed to remain at rest till the fœces have subsided. Two drachms of this mixture, added to an ounce of water, form a collyrium of a proper strength to bathe or to be injected into the eye; and it may be strengthened as the eye can bear it.

In this stage of the disease, in conjunction with the Aq. Camphorata, the Vinum Opii, and the Ungt. Oxid. Hydr. Rubr. may be used in the manner recommended for chronic opthalmia.

When the inflammation is gone, if there should remain any ulceration or opacity of the cornea, two or three drops of a solution of the nitrate of silver, in the proportion of one grain of the salt to an ounce of water, may be put into the eye morning and evening, while the Ungt. Oxid. Hydr. R. is used at bedtime.

## HORDEOLUM OR STYE.

The stye is a small hard inflammatory tumor, situated upon the edge of either of the eyelids; but most commonly on the lower and near the inner angle. From the hard and unyielding nature of the tarsus, it is always attended with great pain, and possesses all the characters of the furunculus or boil,—that is to say, it is an unhealthy inflammation, of a dark red colour, attended with a scalding throbbing pain; the tumor is firm to the touch, never terminates in perfect suppuration, and its centre is filled by a slough, which, when removed, leaves a small cavity, with a hard base.

The stye is a common and troublesome complaint, is very prevalent in drinkers of ardent spirits, and seems to be much connected with a deranged state of the stomach. In those who are particularly subject to the disease, the eyelids remain thickened and inflamed; the tarsus is deprived of its hairs, and during its presence there is a vitiated secretion from the meibomian glands, which seals up the eyes during the night.

### TREATMENT OF HORDEOLUM, OR STYE.

As stye is an unhealthy inflammation, it should be attempted to be brought to suppuration, and in all its stages treated like the common furunculus. In its early and inflammatory state, the best application is to foment and to steam the eyelids with water as hot as the patient can bear. This should be done at least four times a-day, for twenty minutes at a time; and each fomentation should be followed by the application of a warm poultice, made of bread and milk, and secured betwixt the folds of a piece of linen. This practice will be found to be the most effectual in removing the distressing heat, lessening the pain, and softening the tumor; but if the pain is very great, warm solutions of lead, or of opium, may be used instead of the steam of hot water; and when the tumor has become soft, if it does not ulcerate and discharge its contents, it should be opened with a lancet. As soon as the central core or slough is discharged, astringent washes, composed of alum, or the sulphate of zinc, or the acetate of lead, dissolved in water, should be used during the day, and the Ungt. Oxid. Hydr. R. applied at bedtime. When the basis of the tumor remains hard, the induration may be destroyed by touching it with argentum nitratum, or it may be removed by the knife.

Independently of this local treatment, the bowels should be freely opened, and great attention paid to the gastric system, particularly in those who are subject to the complaint.

## PTOSIS, OR RELAXATION OF THE UPPER EYELID.

The upper eyelid sometimes overhangs the eye so completely, as to cover it and prevent vision. The levator muscle having lost its power, the patient is unable to raise the eyelid, and when he wishes to uncover the eye, he is obliged to push up the lid with his finger. This defect may arise from one of four causes; an irregular spasmodic contraction of the orbicularis muscle, generally symptomatic of some other disease; paralysis of the levator palpebræ; a congenital elongation of the skin of the upper eyelid; and relaxation and thickening in consequence of previous inflammation. The first two belong to the province of the physician, and the last two to that of the surgeon.

### TREATMENT OF PTOSIS.

The inability to raise the upper eyelid, depending upon a preternatural elongation of the skin, or a relaxation in consequence of previous inflammation, may be remedied by a surgical operation. This consists in removing a portion of the skin by means of a pair of crooked scissars, and then bringing the edges of the wound together and retaining them by suture. The portion to be removed should be taken from the middle of the eyelid, at its upper part, parallel with, and close by the edge of the orbit. The surgeon should, by means of his finger and thumb, lay hold of as much skin as he judges is sufficient to enable the levator muscle to exert its power over the eyelid; and when he has ascertained this point, he keeps up the raised skin with a pair of small forceps, while with the crooked scissars he cuts it entirely out. The wound is to be then closed by passing one or two cambric needles through its edges, which are to be retained by ligature, in the form of the twisted suture, and supported by black court plaster.

## LAGOPTHALMUS, OR HARE EYE.

It sometimes happens that the eyelids cannot be shut; and thus the eye, remaining uncovered, is exposed to too much light, to dust, and other foreign bodies, all which are productive of great irritation. This defect most commonly resides in the upper eyelid, and may arise either from scars in the integuments, or from paralysis of the orbicularis muscle. In the latter case, the palsy may be solely confined to the muscle of the eyelid, or this muscle may be affected in common with those on that side of the face.

## TREATMENT OF LAGOPTHALMUS.

When lagopthalmus depends upon paralysis, a cure must be attempted by blisters and frictions, with stimulating embrocations. When it arises from contractions in the skin, the cicatrices must be set free by incision, the eyelids stretched, and reunion prevented by the interposition of lint, so as to heal by suppuration and granulation. There are particular states of the eyelids where this practice proves inefficient, as may be seen in the following article.

## ECTROPIUM.

Ectropium is a painful eversion of the eyelids. The disease is generally situated in the lower eyelid, and when it has been of long continuance, or is inveterate, the tears flow perpetually over the cheek, which becomes inflamed and excoriated; the surface of the eye-ball is dry and painful; the patient is continually afflicted with a chronic opthalmia; and there is an inability to bear the light. When the eyelid has been long everted and exposed to the air, the lining conjunctiva becomes very vascular and thickened; acquires a fleshy appearance; and, from the continued irritation and inflammation of the eye-ball, arising from exposure, the cornea at length ulcerates, or becomes dim or opaque, by which vision is either wholly lost, or greatly obscured.

Ectropium may be produced by two causes: A relaxation of the conjunctiva of the eyelid, in consequence of purulent, severe, or long continued opthalmia; and a contraction of the skin, covering the lower eyelid, induced by small-pox, burns, or the removal of tumors from the side of the nose, or upper part of the cheek. In the first case, the eyelid gradually becomes everted, and falls over the cheek; its inner surface or lining membrane assumes a fleshy appearance, but can be easily replaced so as to cover the eye. In the second case, the eyelid is pulled down, or everted, in proportion as the cicatrix, induced by the small-pox, burn, or removal of the tumor, forms, and is so shortened, that it cannot be brought up to cover the eye.

Whether the ectropium depends upon a diseased conjunctiva, or arises from cicatrices in the skin, the lining membrane, from exposure to the air, soon becomes thickened and fleshy; and when the disease has been of long continuance, it assumes a white and callous form.

## TREATMENT OF ECTROPIUM.

When ectropium arises from inflammation, and depends upon a relaxation of the lining membrane of the eyelid, Scarpa * advises the cure to be attempted in slight cases by caustic; but when the disease is more inveterate, by excision, that is, by cutting away the thickened and inflamed conjunctiva lining the eyelid with a pair of fine scissars.

The practice will no doubt frequently succeed in this species of the disease; but when ectropium depends upon a contracted state of the external skin, arising from scalds or burns, the destruction by caustic, or the excision of the lining membrane of the eyelid, will not effect a cure; and Scarpa,

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* See Practical Observations on the Principal Diseases of the Eyes. Translated from the Italian of Antonio Scarpa, by James Briggs. P. 133.

under these circumstances, considers the disease as incurable. It may, nevertheless, be remedied to a considerable degree by cutting away a portion of the lining membrane of the eyelid, when the cicatrix formed, will to a certain extent, bring the lid towards the ball of the eye.

Heister,* with the generality of modern surgeons, recommends to make one or two semilunar incisions in the external skin of the eyelid, so as to free it from the cicatrix, and allow the skin to stretch. The incisions are then to be stuffed with lint, and the edges of the eyelids retained in contact by sticking plasters. By this practice, it is imagined the skin will be prevented from uniting again; the incisions filled up by granulations; the skin elongated, and the eyelid restored to its natural situation. But this operation never succeeds. Mr. Saunders, a most expert oculist, performed it in the London Eye Infirmary without success. "The conjunctiva was everted nearly half an inch, and gave the patient so much pain when the eye was exposed to the influence of any irritating cause, that he had for some time kept it bound up. Mr. Saunders proposed an operation as the only means of affording relief, to which the man gladly assented. On the adhesion between the eyelid and the cheek being carefully separated with a scalpel, the lid was replaced by the finger in its natural situation without any difficulty, but the moment that support was withdrawn, it again fell back to its former position. By strips of adhesive plaster, the lid was kept up for some time tolerably well; but as soon as the wound began to heal, an union again took place between the divided parts, which produced nearly as much deformity as before."*

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* See a General System of Surgery, by Laurence Heister, vol. i. p. 373.

I once assisted Mr. John Bell in the same operation, and with the same ill success. It was in a boy of nine years of age, who had ectropium from a burn, and although the eyelid was easily replaced after the incision, the edges of the tarsi retained in contact by sticking plaster and glue, and the parts carefully supported by small pieces of wood and bandage, yet the eyelid gradually again everted as the incision filled up, and when cicatrized, the deformity was as great, and the disease as complete, as before the operation.

Banister,† the earliest professed writer on the diseases of the eyes with whom I am acquainted, recommends, like Scarpa, where the disease arises from inflammation, to destroy the lining membrane by caustic, or, if more inveterate, by excision. When the disease is incurable by these means, he directs two cross incisions to be made in the inner surface of the eyelid, beginning in the middle and lower part of it, and carrying them both outwardly, one to the greater and the other to the less angle, cutting out the intermediate piece like the Greek letter Lambda, but taking care to avoid cutting the skin. The narrow part of the incision points to the bottom of the eyelid, and the broad part or base of the triangle is directed to the edge or tarsus. If the disease arises from a burn or cicatrix, he at the same time recommends an incision to be made in the outward skin, near the eyelid, extending from one corner of the eye to the other, and to fill the incision with lint, to prevent reunion of its lips.

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* See Practical Observations on Ectropium, by Sir William Adams, p. 9.

† See A Treatise of One Hundred and Thirteen Diseases of the Eyes and Eyelids. By Richard Banister, Master in Chyrurgery, Oculist, and Practitioner in Physick. London, 1622.

In the Memoirs of the Royal Academy of Surgery, there is a case of a reversion of the lower eyelid cured by Le Dran.* The disease occurred in a young man of nineteen years of age, and arose in consequence of an ill-performed operation for the fistula lachrymalis. The deformity was much increased by a tumor of the size of an olive, which was situated in the thickness of the eyelid, and extended from its middle to the great angle of the eye.

Le Dran first removed this tumor, and at the end of two months, when the wound was completely healed, he performed a successful operation for the reversion of the eyelid. He seized and fixed the reversed eyelid with a pair of small forceps, and began an incision close by the lachrymal point, betwixt it and the nose. He continued his incision on the side of the nose, taking away no more than a line or two of the thickness of the parts. He did the same to the upper eyelid, terminating the incision on the side of the nose at the part where the former ended. He removed all the surface of the space betwixt the two incisions, and made a triangular wound, of which every side was seven or eight lines in length, the lips of the wound were brought into contact, and secured by two stitches, supported by sticking plasters and bandage. At the end of three weeks this young man was so completely cured, that there was only a simple scar to be seen.

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* See Mémoires de l'Académie Royale de Chirurgerie, tome ii. 12mo.

Sir William Adams, a late writer on ectropium, has proposed and practised a new method, which appears to me to be a perfect operation, and which he says he has found successful, even in ectropium arising from burns.

With a pair of fine straight scissars he cuts out an angular portion of the eyelid resembling the letter V, then removes the diseased conjunctiva, lining the eyelid, and lastly brings the cut edges in contact by means of the interrupted suture. The effect of this operation is to shorten the eyelid, and when the opposite lips unite, it is found to have regained its natural situation, and accurately to cover the ball of the eye. As the motion of the eyelid is apt to prevent adhesion of the cut surfaces by the first intention, we should always take out the piece near the external angle, where the motion is less, and the portion to be removed must depend upon the extent of the disease. If too small a portion be removed, the eyelid will hang loose, and the disease be reproduced as soon as the parts unite; while again, if too large a piece be cut out, the parts will be kept so much on the stretch, that, instead of adhering they will ulcerate.*

This operation is undoubtedly the best, and apparently the most successful of any which has been proposed for ectropium. After it has been performed, a compress should be placed on the eyelid to support it, and secured by a bandage. In the progress of the cure, the eye may be occasionally bathed with solutions of the acetate of lead, or the sulphate of zinc.

## ENTROPIUM.

Entropium is an inversion of the eyelid, by which its cartilaginous edge is turned inwards, and the cilia or hairs, then coming in contact with the sensible surface of the eye, excite pain and inflammation. This disease occurs most frequently in the upper eyelid; is in general partial, seldom, like ectropium, involving the whole eyelid.

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* Practical Observations on Diseases of the Eye. By Sir William Adams.

Various causes of this disease have been assigned, such as relaxation of the external skin of the eyelid, spasm of the orbicularis muscle, &c.; but it most frequently arises from the scars produced by an inflamed and ulcerated state of the lining membrane, or from a diseased state of the bulbous roots of the cilia, or cartilaginous edges of the eyelid and meibomian glands.

## TREATMENT OF ENTROPIUM.

There is a way of curing this disease recommended by Banister, St. Ives, Scarpa, and other writers on the eye, which is generally successful. This is by cutting out a portion of the external skin of the eyelid close to the tarsus, when the cicatrix, formed by the healing of the wound, will completely evert the ciliary edge, and effect a perfect cure. The operation is extremely simple. The surgeon has only to raise as much of the loose skin with his forefinger and thumb as he perceives is sufficient to bring out the edge of the eyelid and place the hairs in their natural situation, when he takes a pair of crooked probe-pointed scissars and cuts out the piece of skin. The only caution he has to attend to is to cut as near the edge of the eyelid as possible, otherwise the operation would be fruitless, the cicatrix being too far removed from the tarsus to have any effect upon it. The edges of the wound must next be placed in contact, and retained by means of a fine sewing needle and harelip suture, which is the preferable manner of treating, not only wounds of the eyelids and lips, but all the wounds of the face.

## EYCYSTED TUMORS OF THE EYELIDS.

The eyelids are frequently the seat of melicerous, fatty, and other tumors. They more commonly occur in the upper than in the lower eyelid. When the tumor is large, and situated in the former, it produces Ptosis, or inability to raise the lid; and when in the latter, Ectropium, or eversion. Sometimes it is situated immediately under the skin, in which case the tumor is loose and very moveable; at other times it lies under the fibres of the orbicularis muscle, adheres to the lining conjunctiva, and is then more fixed. The tumor, when at first discovered, is perhaps of the size of a millet seed; gradually becomes larger, and has always a tendency to increase in bulk. When it acquires the size of a horse bean, it begins by its pressure to irritate the ball of the eye and excite inflammation, to prevent the free motion of the eyelid, and to cause deformity. About this time the patient generally applies for surgical assistance.

## TREATMENT OF ENCYSTED TUMORS OF THE EYELIDS.

As tumors of the eyelids not only cause deformity, but are productive of uneasiness, they should be removed by a surgical operation. When they are situated under the orbicularis muscle, and connected with the lining conjunctiva, they will be very readily removed, and without deformity, by everting the eyelid, and dissecting them out from the inside; but when they are placed external to the muscle, which, I believe, is most frequently the case, the preferable mode of procedure is to remove them by cutting through the skin. The incision should always be made transversely, or in the direction of the edge of the eyelid. This will leave a less visible scar; and if it is necessary to divide the orbicularis, the muscle will then be cut in the direction of its fibres. After the tumor has been exposed, the surgeon should lay hold of it with a fine hook, and having insulated it with the knife, he may either separate it at its base with the same instrument, or cut it off with the curved scissars. From the looseness of the skin, and the course of the incision with reference to the muscle, all that is necessary to secure the wound is a piece of black court plaster.

## TUMOR OF THE LACHRYMAL GLAND.

The lachrymal gland is sometimes simply enlarged, and has nothing malignant in its nature, although from its increased bulk it pushes forwards the ball of the eye, causing it to protrude from the socket, and producing blindness and great deformity. At other times, the swelling is hard, has an irregular and scirrhous feel, and, when it becomes painful, is apt to degenerate into cancer.

In the progress of enlargement of the lachrymal gland, the patient is distressed with a dull pain in the upper part of the orbit towards the temple; he feels as if the eye were pushed from the socket towards the nose, and, when he attempts to roll it, great stiffness, with increased pain. As the disease advances, the eye becomes hot and dry, and is gradually protruded from the socket; all power of moving it is lost; and vision becomes more and more indistinct, till at last the eye is so distorted that total blindness ensues.

From the gland being covered by the conjunctiva, the tumor may, in an early stage, be taken for a disease of that membrane; but the seat of the affection may be always readily determined by the situation and circumscribed form of the swelling.

## TREATMENT OF TUMOR OF THE LACHRYMAL GLAND.

WELLER observes, that "there is no cure for a scirrhus of the lachrymal gland, and that Beer rejects its extirpation;"* but, in opposition to this opinion, we know that the lachrymal gland, when diseased, is easily extirpated, and that this is in general a successful operation. All that the surgeon has to attend to is to cut in the inner side of the eyelid; and, to give him freedom to effect this, the skin should be divided for a short space transversely, in the direction of the eyelid, beginning at the external angle, and carrying his incision towards the temple. He dissects betwixt the eyeball and the orbit; and when the tumor is fairly exposed, he should lay hold of it with a hook and pull it gently from its bed. This will enable him the more easily to remove it; and when it has been dissected out, the wound in the skin is to be brought together by sticking plaster, and the parts supported by compress and bandage. Though the tumor has been so considerable as to force the eye from the socket, and thus injure vision, it has been observed, that after its removal, the eye has returned into the orbit, and its sense has become perfect.

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* See a Manual of the Diseases of the Human Eye, translated from the German of Charles H. Weller, by George C. Monteath, M.D. 2 vol. 1821, vol. i. p. 153.

## STILLICIDIUM LACHRYMARUM, AND FISTULA LACHRYMALIS.

When the tears do not pass by the lachrymal apparatus into the nose, but flow over the cheek, the disease is properly termed a Stillicidium Lachrymarum; and when they are discharged through an ulcerated opening in the lachrymal sac, the complaint then assumes the name of Fistula Lachrymalis. These two states of disease, although quite distinct, have been confounded with each other, particularly by the writers of this country. The former affection may exist for life without being followed by the latter, although the latter cannot occur without being preceded by the former. A stillicidium lachrymarum may arise either from a closure of the puncta, or a contraction or obliteration of the canals leading from them to the lachrymal sac; from a stricture or total obliteration of the nasal duct; or from an inflammation in the mucous membranes of these passages. The first of these causes is extremely rare, the disease generally depending either upon a stricture in the nasal duct, or on an inflammation of the lachrymal sac. The stricture in the duct is a disease incident to this tube, as well as to other hollow passages which are lined by mucous membranes, and the inflammation of the lachrymal sac may arise from a variety of causes. It sometimes follows measles and smallpox; often presents itself as a consequence of scrophula and syphilis; may arise from a common cold, or be induced by the vitiated secretion of the meibomian glands entering the puncta along with the tears. When the stillicidium lachrymarum is produced by a stricture in the nasal duct, and the lachrymal sac, as yet uninflamed, is pressed on by the finger, the tears are poured out pure by the puncta. This is always the case in the early stage of the disease, although after it has subsisted for some time the sac becomes inflamed, and its secretion is altered. This change takes place here in the same manner as it does in the urinary bladder from the resistance produced by a stricture in the urethra. When the stillicidium arises from an inflammation in the sac, if it be compressed by the finger the tears will regurgitate through the puncta, streaked with pus or with thickened mucus; and when this inflammation has been induced by a vitiated secretion from the meibomian glands entering the puncta along with the tears, the lining conjunctiva of the eyelids will, upon examination, be found to be inflamed; the meibomian glands and their ducts enlarged; the cilia covered with a glutinous matter; and the eyes sealed up during the night.

When the nasal duct is obstructed, the saccus lachrymalis swells, and forms a small tumor at the internal canthus. There is at first neither pain nor discoloration of the skin; when pressed upon with the finger, if the sac is uninflamed, the tears mixed with the natural mucus, are poured out pure by the puncta; but if the inner surface of the sac is inflamed, they are mixed with pus. Conjoined with this state of the sac, there is a dryness of the nostril of the affected side, and an increased secretion of the tears, because the lachrymal gland secretes the tears in greater quantity from the increased excitement produced by the irritation of the neighbouring parts. From the obstruction of the duct, the tears not only flow over the cheek, but also collect in the eye, and greatly obscure vision. This affection, properly speaking, is what is called Epiphora, or Stillicidium Lachrymarum, and if pressure be regularly applied to the sac, it may always be completely emptied, and the disease will then make so little progress, that it may be kept stationary for many years, or even life.

Although this state of disease is extremely troublesome, it is not attended with much pain; but it often happens that the sac becomes much inflamed, swells, and thickens; the skin loses its natural colour, and becomes hard, inflamed, and painful; the inflammatory action still going on, the sac and integuments at length ulcerate, and the inflammation, in some cases, extends to the neighbouring parts, as the cheek and nose. The disease is now attended with considerable pain, and sometimes with fever; the tunica adnata becomes slightly inflamed; the eye is irritable, feels weak, and is unable to bear the light; the ulcer sends out a fungous excrescence; and the patient is much distressed with a perpetual weeping. Sometimes the swelling and pain subside; the ulcerated orifice gradually contracts; its edges become callous, and the matter is discharged by this small opening. This is the state of the disease which is properly termed Fistula Lachrymalis; and when it has been of long continuance, or when there is any constitutional affection, particularly venereal, the os unguis is often carious. Such a state of that bone may be suspected when there is a fœtid ichorous discharge, and when the ulcerated surface is covered with grayish coloured fungi, while its actual existence may be ascertained by the probe.

## TREATMENT OF STILLICIDIUM LACHRYMARUM, AND FISTULA LACHRYMALIS.

SURGICAL writers have ascribed stillicidium lachrymarum and fistula lachrymalis, rather to a permanent obstruction in the nasal duct, than to inflammation of the mucous membrane. Hence the chief methods of cure have consisted in attempts to open the duct by means of probes, tubes, and setons, or to establish a new canal by perforation with a trocar. Although the diseases under consideration be sometimes attributable to stricture, still they are so frequently referable to inflammation, that milder methods than those which have been formerly adopted are now found sufficient to cure them. The late Mr. Ware paid much attention to this subject, and we are principally indebted to him for the simplicity of practice which prevails, although it would appear that he conceived the evil to consist chiefly in obstruction in the nasal duct, and that his great aim was to overcome this obstruction.

In the early stage of the disease, when there is merely a weeping eye, and no ulceration of the lachrymal sac, if the puncta pour out pus along with the tears when the sac is pressed on, the surgeon should wash it out twice or thrice a-day with solutions of the acetate of lead, or the sulphate of zinc. This is readily effected by a small syringe adapted to one of Anel's tubes, which is to be introduced into the lower punctum. These solutions not only wash out the sac, but, from their sedative and astringent nature, allay the inflammation; and, that they may be fairly applied, and carried, if possible, down into the nose, the upper punctum should be covered with the finger, while the fluid is injected by the lower. At the same time that this treatment is pursued, the eye should be bathed frequently in the course of the day with the same solutions; and if it is observed that the lining membrane of the eyelid, and the meibomian glands, with their ducts, are also diseased, a little of the Ungt. Oxid. Hydr. R. or the Ungt. Subacet. Cupri, should be inserted betwixt the eyelids every night at bedtime, as recommended in Psorophthalmia.

When the weeping eye depends upon inflammation, and when the disease is not far advanced, this mode of practice will seldom fail to effect a cure; but if it should not be successful, and more especially if the surgeon has reason to suspect that there is any stricture in the nasal duct, he should pass one of Anel's small probes by the upper punctum into the sac, and endeavour to carry it down into the nose. This is easily accomplished by raising and everting the upper eyelid at the inner angle with the thumb of the left hand, while with the thumb and forefinger of the right he introduces the probe into the superior punctum, carrying it obliquely downwards and inwards into the lachrymal sac. When he has entered the sac, he should raise the probe so as to touch the eyebrow, and thus placing it in a perpendicular direction, carry it directly downwards. At the same time that he directs the probe downwards, if he gives it a twirling motion it will easily enter the nasal duct, and if the obstruction is not very great, he will without much difficulty be able to carry it into the nose. After the surgeon has once succeeded in introducing the probe, the subsequent introductions will always be more easy; and he should repeat the operation daily, increasing the size of the instrument, till such time as he is able to introduce the largest of Anel's probes. As the chief obstacle to the introduction resides in the punctum, this point should be dilated by a smaller instrument, when one of a size which it will not at first receive will afterwards pass easily along.

If this mode of treatment, conjoined with the use of the injections and collyria, still prove inefficacious, the next step is to open the sac, and through the opening to pass one of Mr. Ware's styles, or a piece of bougie, into the nose. In opening the sac, the surgeon should lay the thumb of his left hand upon the lower eyelid, and by stretching it towards the external angle, he will expose the tendon of the orbicularis muscle covering the upper part of the sac, and thus prevent it from being wounded. While the eyelid is stretched, and the sac distended with the tears, a sharp-pointed bistory should be entered immediately under the tendon, and carried downwards to the edge of the orbit, or a lancet may be passed in at the edge of the orbit, and carried upwards to the tendon. When the sac is opened, a probe or a small style should be introduced at the opening, and by a gentle pressure the surgeon should endeavour to carry it perpendicularly downwards into the nose. If he succeeds in carrying it through the duct, he should allow it to remain, and, although at first fixed so as to be with difficulty withdrawn, it will be so loose on the following day, as to be easily taken out, when a style of a larger size should be introduced. By increasing the size of the style every second or third day, the passage will be gradually enlarged to its original size, and by persevering in the use of the instrument, taking it out daily to clean, and again introducing it, the natural course of the tears will be re-established. The style is productive of little inconvenience, the tears flowing as easily by the side of it as through a tube. It should be worn till all inflammation in the eye and lachrymal passages has subsided, and until the course of the tears is completely re-established, after which it should be withdrawn, when the opening into the sac will immediately heal up.

When the sac ulcerates, pus along with the tears is discharged through the ulcerated opening, the eyelid and upper part of the cheek are much inflamed, and there is a great degree of hardness. In this case warm emollient poultices should be frequently applied. After the inflammation has somewhat abated, if the opening is small it may be dilated by the introduction of a piece of sponge tent; and when the inflammation is gone, the probe and styles are to be introduced and worn, as already recommended. If the surgeon should find himself foiled in all his attempts to restore the natural passage of the tears, as the disease is one of a very distressing nature, it will be necessary to make an artificial opening. I may, however, observe, that this procedure is seldom necessary, and that such an operation is now much more rarely performed than in the days of Mr. Pott, who was a great advocate for perforation. The os unguis is the separating barrier betwixt the orbit and the cavity of the nose, and if perforated or removed, the communication is open and direct betwixt the two cavities. The operation therefore consists in perforating the os unguis with a trocar, so as to make an artificial in place of the natural opening. As the opening is very apt to close up, in consequence of the Schneiderian membrane shooting out fungi, the trocar, which should be curved, ought to be much thicker than what is generally employed.

In this respect the ancients were more successful than the moderns, because they always made a large opening by destroying the os unguis with the actual cautery. In perforating, the trocar should be carried obliquely downwards towards the inside of the nose, so as to avoid the upper spongy bones. When the perforation is completed, there will be a discharge of blood from the nostril, and of air and bloody froth from the corner of the eye upon blowing the nose. A large style should be immediately introduced and worn till the new passage becomes callous. As it produces no inconvenience to the patient, and as the tears flow immediately by the side of the style, it may be retained for any length of time. Our success in this operation depends upon a large and free opening. Lamorier, who has written a short paper on this subject,* recommends the os unguis to be perforated with a pair of curved and pointed forceps; and then the opening to be farther dilated by divaricating the handles of this instrument. I believe this to be a most successful mode of performing the operation. It is hardly necessary to observe, that the natural opening of the nasal duct is below the inferior spongy bone, while the artificial or new opening will be above it.

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* See Mémoires de l'Académie Royale des Sciences, an. 1729.

Fistula lachrymalis is a troublesome disease, and frequently requires a variety of treatment; but by attention and perseverance the surgeon will in general ultimately effect a cure.

## PTERYGIUM.

The pterygium is a reddish or ash coloured membrane, of a triangular shape, generally beginning at the inner canthus of the eye, and gradually stretching towards the cornea, which it sometimes partially and sometimes wholly covers. It has its name from its resemblance to the wing of a bat, and is devoid of pain. When the cornea is partially covered, the vision is obscured; when it is wholly covered, it is completely lost. Although this membrane is generally situated at the inner angle of the eye, it sometimes commences at the external angle, and still more rarely at the upper or lower part; but wherever the pterygium is situated, it is always of a triangular shape, with the base of the triangle on the white of the eye, and the apex on the cornea. When the membrane is red, thick, and vascular, it is termed Pannus.

This disease presents itself only in the very worst cases of Opthalmia, often follows the smallpox and measles, and occurs at all periods of life; but it is not a necessary consequence of inflammation of the eye, for, notwithstanding the frequency of opthalmia, Pterygium is a rare disease. Pterygium seems at first sight to be a newly formed membrane covering the cornea, but when minutely examined, it will be found to be only a varicose, thickened and opaque state of the membranous continuation of the conjunctiva covering the cornea. That this is the case may be easily shown, by laying hold of the varicose and relaxed adjoining portion of the conjunctiva with a pair of small forceps, when they will be raised together in one fold.

Pterygium may be distinguished from all other diseases of the conjunctiva and cornea by its triangular form and the looseness of its attachments.

## TREATMENT OF PTERYGIUM.

The best method of attempting the cure of pterygium is by extirpation. The surgeon should lay hold of the morbid membrane with a pair of small forceps, close by the junction of the sclerotica and cornea, and pulling thereby gently to raise it, he, with a pair of curved eye scissars, separates it from the cornea, beginning at the apex of the triangle, and dissecting backwards to the base, till he has removed the whole diseased substance. In this manner the disease may be effectually removed, more especially if the pterygium is recent; but although a cure be effected, vision is never entirely restored, because from the natural covering of the cornea being dissected off, a scar is always left, which in a great measure destroys its transparency. Any hemorrhage that may follow the operation should be promoted by bathing the eye with warm water; and after it has ceased, a bit of lint, wet with a saturnine solution, should be applied. If symptoms of inflammation supervene, the surgeon must have recourse to the usual antiphlogistic remedies.

When the pterygium has been of long standing, and the membrane is hard, it is sometimes difficult or impossible to dissect it off. In this case the surgeon must have recourse to caustic, which should be applied by means of a hair pencil.

## ENCANTHIS.

The encanthis is a soft mulberry-like excrescence, growing from the caruncula lachrymalis, or from the semilunar cuticular fold which surrounds it. As the tumor increases in size, the eyelids become separated at their inner corner, and the puncta lachrymalia are pressed upon; the tears consequently cannot get into the nose, but flow over the cheek. The constant irritation occasioned by this disease keeps up a perpetual ophthalmia. After subsisting for some time, it advances along the inner surface of both eyelids towards the external canthus, and the body of the tumor sometimes extends from the caruncula nearly to the edge of the cornea. It is generally of the size of a large pea, but sometimes acquires the bulk of a brambleberry; and there are cases on record where it has attained the size of the fist.* The encanthis seems to be of two kinds, or at least there are two stages of the disease. In the first, the tumor is loose, red, and free of pain; in the other, it becomes very hard, bleeds on the slightest touch, and is attended with lancinating pain, not only through its substance, but also through the eye and forehead; in short, assumes all the malignity of cancer.

## TREATMENT OF ENCANTHIS.

The destruction of encanthis has been attempted by escharotics; but when the disease is of a benign nature, or when taken early, the cure is best effected by extirpation. The surgeon should raise the tumor by means of a pair of forceps, or small hook, and dissect it off from the caruncula and conjunctiva with curved scissars. The eye must afterwards be repeatedly bathed with some astringent lotion; and if there remains any ulceration, which does not readily heal, it will be advisable to touch it with the argentum nitratum.

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* See Weller and Boyer.

When the disease is of a malignant nature, and, from the extent of its attachments, cannot be readily extirpated, or when it returns after extirpation, it will be necessary to remove the whole eye.

## SECTION II.

### DISEASES OF THE EYEBALL.

Whilst the majority of those diseases which affect the appendages of the eye are only productive of inconvenience, those to which the eyeball is exposed are of a more serious nature, as they are uniformly attended with a partial or total loss of vision, and on some occasions even involve the life of the patient. The most important are the following :

1st, Ophthalmia Iridis, or Internal Inflammation of the Eye.
2d, Pustules of the Cornea.
3d, Ulceration of the Cornea.
4th, Opacity of the Cornea.
5th, Staphyloma, or Opaque Tumor of the Cornea.
6th, Procidentia Iridis, or Prolapsus of the Iris.
7th, Closure of the Pupil.

8th, Hypopion, or Abscess in the Anterior Chamber.

9th, Hydrophthalmia, or Dropsy of the Eye.

10th, Cataract.

11th, Amaurosis, or Gutta Serena.

12th, Fungus Hematodes.

13th, Cancer.

## OPHTHALMIA IRIDIS, OR INTERNAL INFLAMMATION OF THE EYE.

The most vascular textures of the eye are the conjunctiva, the iris, the ciliary processes, and the choroid coat. The first, as we have already remarked, is the seat of external, and any of the three latter may be that of internal ophthalmia; but although inflammation of the eye is most generally situated in one or other of these coats, all the other coats, of which this organ is composed, are liable to inflammation. Internal ophthalmia may present itself under two forms. It may arise from external inflammation being communicated to the deep-seated parts of the eye, or the internal coats may be attacked with this disease without any affection of the conjunctiva. In the former case, the symptoms are more acute, and the disease more rapid in its progress; in the latter case, the symptoms are more obscure, and the disease runs a slower although not a less destructive course. When the internal parts of the eye are attacked with inflammation, its appearance is always most conspicuous in the iris, and its consequences more apparent in that membrane. Hence this inflammation has been denominated Iritis, although it is probable that the ciliary processes and the choroid coat will, from their continuity, also soon participate in the inflammation.

When internal ophthalmia occurs as a sequence of external inflammation, or takes place at the same time, as the patient is unable to bear the light, no accurate examination can be made, so that the internal changes in the eye cannot be perceived: But we conclude, that the inflammation has extended to the internal parts from the deep-seated pain in the orbit; from the tension of the eyeball, and great tenderness when pressed on; from a total inability to bear the light; from pain shooting from the bottom of the orbit through the head; from a fixed pain in the forehead; from a feeling as if the eye were too large for its cavity; from a sensation of its being pushed from its socket; and from the symptoms being accompanied with a high febrile action. When inflammation of the iris is unaccompanied by external inflammation, the symptoms, progress, and consequences of the disease can then be more accurately traced.

Inflammation of the iris most frequently arises from wounds or other injuries in operations on the lens for the cure of cataract; sometimes presents itself as a secondary symptom in syphilis; is also by no means uncommon in gouty habits;

and is said frequently to follow the long-continued and imprudent use of mercury. In the first of these cases, viz. that arising from wounds or local irritation, independently of the nature and situation of the pain, the inability to bear the light, and the other symptoms of ophthalmia, remarkable changes are observed in the iris. The pupil becomes irregularly contracted; the motions of the iris diminish by degrees; and this membrane thickens. The first apparent changes are observable in the lesser circle, or pupillary margin, which becomes of a darker colour, with thickened and serrated edges turned backwards towards the posterior chamber. The larger circle, or ciliary margin, then begins to acquire a greenish hue, if the natural colour was gray or blue; but when originally brown or black, it becomes of a reddish colour. The inflammation extends to the adjoining structures, and, from its continuance, coagulating lymph is effused into the pupil. This effusion appears in the form of a delicate grayish flake, closing up the opening, and adhering to the serrated pupillary edge of the iris. If the action is violent, and the inflammation affects the contiguous parts, farther effusion takes place into the posterior chamber, by which the iris adheres to the capsule of the lens, or to that of the vitreous humor. The inflammation continuing, the iris becomes thicker, and approximates the cornea, which loses its transparency, and to which it adheres; or small yellow pustules appear on the surface of the iris in the form of little abscesses, which burst and pour their contents into the anterior chamber. Although the iris be highly inflamed, there is not much redness in the conjunctiva; but the vessels of the sclerotic coat are seen of a rose or pinkish colour, and running towards the cornea, round the margin of which they form a distinct circle, from which vessels pass into the iris. While these vessels are numerous round the cornea, towards the outer part of the sclerotica they are few in number, and so diffuse as hardly to change the colour of this coat.

Deep-seated inflammation of the eye, according to its violence and duration, affects the organ in very different ways. If the inflammation is confined to the iris, and the action is not very violent, a small portion of coagulating lymph is effused into the pupil, which either does not adhere to the pupillary margin in the whole circle, or is in a great measure absorbed. The pupil remains then only partially closed, and vision is not entirely destroyed, but only impaired. When the effusion and adhesion are so complete, as entirely to obliterate the pupil, the iris remains immoveable, and vision is entirely lost; but if the iris does not adhere to the ciliary processes, to the capsules of the lens, or of the vitreous humor, or to the cornea, by which the anterior chamber would be destroyed, the case is still remediable by an operation. Lastly, when there is an extensive internal suppuration or adhesion, or when the anterior chamber is obliterated, vision is completely destroyed, and no operation can restore it.

The history which we have now given is illustrative of the idiopathic iritis, or that species of the disease which depends upon local irritation in a healthy system; but Schmidt and other writers on the eye have enumerated three other species, a syphilitic, an arthritic, and a mercurial iritis; which may be distinguished by the following marks:—

The syphilitic inflammation of the iris may be known by the slow progress of the disease, by the chain of vessels in the sclerotic coat encircling the cornea being of a copper or cinnamon colour, accompanied by a muddiness or diminished transparency of the cornea, by a nocturnal pain situated above the eyebrow, and by the history of the case.

The arthritic iritis is characterized chiefly by a rending pain in the eye shooting through the head, and extending throughout the whole of that side of the face; by the red vessels which cover the sclerotic coat not reaching quite to the cornea, but terminating so as to leave a pearl-coloured circle round the latter, which, when the inflammation is completely developed, becomes very distinct; and by the enlarged vessels which appear in the conjunctiva soon becoming varicose and of a purple colour. This varicose and dark-coloured state of the vessels is considered as quite peculiar to this species of iritis. Arthritic inflammation of the iris is apt to be followed by a diminution of the size of the eye, and by a diseased state of the lens and vitreous humor, which become of a sea-green colour, and are followed by a total loss of vision.

In inflammation of the iris arising from the imprudent use of mercury, it is said that the disease is slower in its progress than in either the syphilitic or arthritic iritis; that the pupil is not much contracted; that the blood vessels of the conjunctiva are enlarged, of a livid colour, and stretch to the edge of the cornea, while coagulating lymph is not so apt to be effused as in the other species of the disease. But although Schmidt has given us these marks, I am not aware that the species of iritis, which is supposed to follow the imprudent use of mercury, can be distinguished from syphilitic iritis.

## TREATMENT OF OPHTHALMIA IRIDIS, OR INTERNAL INFLAMMATION OF THE EYE.

When the deep-seated coats of the eye are inflamed at the same time with the conjunctiva, the most prompt and decisive measures must be adopted, to save as far as possible the structure, and prevent the total disorganization of the eye. Independently of the warm anodyne fomentations and local bleedings, the brisk cathartics and other remedies, recommended in external ophthalmia, blood must be freely taken from a vein or from the temporal artery, and the operation repeated at intervals, till all the actions of the system are brought low. The inflammation, if violent and extensive, always terminates in suppuration; when more limited and slower in its progress, in effusion of coagulating lymph, and consequent adhesion. Both these terminations are most readily averted by free local and general bleeding; and when the effusion of coagulating lymph has taken place, adhesion is materially prevented and absorption promoted by the free use of mercury. In this stage of the disease, the application of belladona to the eyebrow or to the eye is also attended with the best effects. As soon, therefore, as the violence of the inflammation is over, mercury should be liberally administered, either externally or internally, or both, and a little of the extract of belladona should be rubbed upon the eyebrow once or twice in the twenty-four hours, or, what is preferable, two or three drops of a solution of the extract may be put into the eye. This solution is made by rubbing five or six grains of the extract with a tea spoonful of water. Its application has the effect, not only of keeping the pupil dilated, but also of subduing vascular action; and, when the adhesions are recent and not extensive, it will frequently, by enlarging the pupil, have the effect of rupturing them, and thus increase the capacity of vision.*

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* I believe the solution of belladona to be the medicine employed by the itinerant oculist, Mr. Williams, in closure of the pupil, and other cases of blindness.

In idiopathic iritis general bleeding is always necessary; but in the symptomatic species of the disease, where the action is less violent, local blood-letting will most generally suffice; and this should always precede the use of every other remedy. The number of leeches applied, and their repetition, must be regulated by the degree of pain; but, immediately after their application, the surgeon should have recourse to the use of mercury, as the most effectual means of checking that process which closes up the pupil and destroys the motions of the iris. It has been remarked, that this medicine is equally valuable in whatever species of the disease it may be employed,* and, that it may have its full effect, it should be administered in such doses, and at such intervals, as speedily to affect the mouth. A good method of exhibiting mercury is to give one grain of the submuriate in combination with two grains of the extract of hyoscyamus three times a-day, and to continue its use till the mouth is affected. At the same time that the patient is put under mercury, the belladona should be frequently used, as the most powerful auxiliary in the cure of the disease. The pupil should be kept permanently dilated, by inserting a few drops of the solution into the eye, twice or thrice in the twenty-four hours.

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* See a valuable paper on iritis, by Mr. Travers, in Cooper's and Travers's Surgical Essays. Part First.

## PUSTULES OF THE CORNEA.

In peculiar states of the constitution, when the conjunctiva is inflamed, small specks of coagulating lymph are frequently deposited upon this membrane, where it covers both the sclerotica and cornea, but they are most commonly situated on the cornea, close by its junction with the sclerotica. These specks are at first of a flattened form, but soon rise into little conical tumors of a dirty white or yellowish colour. Sometimes there is only one, at other times there exist two or three pustules, and either one or both eyes may be affected. In this morbid condition of the eye, the conjunctiva is more vascular than in its healthy state; the vessels, however, are not of a bright red, but of a pale colour. Some of them can be traced running to the pustule, and in its immediate vicinity there is generally a dimness of the cornea. Although the conjunctiva be inflamed, the inflammation is not of an active nature, and the patient is able to bear the light; but these pustules frequently terminate in suppuration, which is immediately followed by an ulcer, and as soon as this occurs the inflammation increases, becomes more active, and is attended with acute pain and intolerance of light. In the pustular state of the conjunctiva, there is always an affection of the meibomian glands and their ducts, attended with a vitiated secretion, which seals up the eyelids during the night. Their lining membrane is very vascular and spongy.

This diseased state of the conjunctiva may occur at any period of life, but more frequently happens in the young, and appears to be connected with a strumous habit.

## TREATMENT OF PUSTULES OF THE CORNEA.

As the tendency to form pustules in the sclerotic and corneal conjunctiva is evidently connected with a diseased state of the system, it is necessary to keep this in view in the method of cure. The vessels of the conjunctiva are relaxed, and the inflammation is of a chronic nature, the local applications should therefore be astringent, and slightly stimulating. The best practice is to bathe the eye frequently during the day with a cold solution of the sulphate of zinc, to insert betwixt the eyelids at bedtime a little of the ointment of the red oxide of mercury, proportioned in strength to the sensibility of the eye, and to introduce every morning two or three drops of the vinous tincture of opium. If any enlarged vessels are seen running to the pustules, it will be advisable to divide them, or what is preferable, to remove a portion of them, either with scissars or with a cornea knife. In long continued inflammations of the eye, the introduction of an issue or seton in the neck is attended with marked advantage.

The foregoing is the treatment we have already recommended for the cure of chronic ophthalmia, and in the present case, the constitutional treatment should consist in tonic and alterative medicines. Small doses of calomel, or Plummer's pill, may be exhibited at bedtime, while the decoction of sarsaparilla is taken during the day. The warm bath has also been found to be of service, and the warm salt water bath is preferable. The use of it may be combined with the internal exhibition of the preparations of iron or of Peruvian bark.

It is requisite that the constitutional treatment should be persisted in for a considerable length of time, with a view both to cure and to prevent a recurrence of the disease; but it has been observed, that after every remedy has failed, the removal of the patient to a warm and dry climate has often effected a cure. Although this diseased state of the eye sometimes prevails in adult years, the frequency of its attacks is more peculiar to early life, and generally disappears of its own accord about the age of puberty.

## ULCERATION OF THE CORNEA.

Ulceration of the cornea most frequently proceeds from the bursting of a pustule, although it sometimes occurs from the injury produced by the introduction of irritating substances into the eye. As soon as the pustule bursts, there follows an accession of inflammation, and an ulcer is immediately formed, covered with an ash-coloured slough. This is merely thickened mucus. The ulcer has high and irregular edges, and discharges an acrid serum instead of pus. It is always attended with most acute pain, particularly on moving the eyelids, and with an intolerance of light by no means proportionate to the existing inflammation. An ulcer on the cornea is at first small, but may extend superficially, penetrate deep, or remain for a long time stationary. When it spreads to any extent superficially, it is apt to be followed by an opacity of the cornea, so as materially to injure vision. When it penetrates so deep as to pass through the thickness of this coat, the aqueous humor will escape; and if the opening be large, from the continued pressure of the recti muscles on the eye, the iris will protrude. When the ulceration exists to a small extent only, it generally heals, so as to leave no visible defect, although when minutely examined, a small hollow or depression may be perceived.

## TREATMENT OF ULCERATION OF THE CORNEA.

Ulceration of the cornea, like that of mucous surfaces, is of an irritable nature; and for ulcers of this description the method of cure is to destroy their irritability, and thus change the nature of the sore. This is best effected by caustics, the most suitable of which appears to be the argentum nitratum. The ulcer may be touched with a strong solution of this salt, by means of a hair pencil, or a piece of the caustic may be cut fine at the point, like a black lead pencil, and applied to the ulcer. Shortly after the caustic has been applied, there is a great diminution of irritability; and in a few hours the inflammation in a great measure subsides. The patient continues to feel comparatively easy till the eschar separates, when the irritability of the ulcer returns, but seldom to that degree which existed at first. As the eschar falls off every second or third day, the application of the caustic must be repeated twice or thrice a-week, and by making every subsequent application more gentle, the irritability will be at last destroyed, and the ulcer assume a healthy action. The absence of the ash-coloured slough, and the red granulating appearance of the sore, are the marks for laying aside the caustic. It may be remarked, that, after every application of this substance, the eye should be immediately washed with warm milk, which has the effect of preventing the caustic from spreading.

Small ulcers are frequently situated on the cornea, which do not possess any very great degree of irritability; or, at least, the irritability of them is so destroyed, after one application of the caustic, that a cure may be effected by means of ointments, collyria, or powders. In this state, I have found the best application to be a powder, composed of equal parts of calomel and loaf sugar, finely levigated, of which a little is to be blown into the eye through a quill every night at bedtime. This acts at first as a slight escharotic, then as a gentle stimulant, and under its use the ulcer gradually lessens in size, till at last it heals up. During the whole progress of this treatment, the eye should be occasionally washed with a collyrium of the acetate of lead, or of the sulphate of zinc.

## OPACITY OF THE CORNEA.

Opacities of the cornea are generally a consequence of inflammation, although they sometimes originate from the cicatrices of ulcers or of wounds, more especially those which have been attended with a loss of substance. The opacity may be very limited in its extent, or may involve the whole of the cornea; and, according to this circumstance, will less or more obscure vision. It is also evident that the sight will be affected in proportion as the opacity is opposed to the pupil. When the opacity is a consequence of inflammation, it is formed by an effusion of coagulating lymph, either below the corneal conjunctiva, or betwixt the lamellæ of the cornea. It frequently occurs in young children, after the inflammation of small-pox and measles, and often disappears spontaneously. Old and deep-seated ones are very difficult to remove. When the opacity is superficial, it is named Nebula, when deep-seated, Albugo, and, when produced by the cicatrix of a wound or ulcer, Leucoma. In nebula, the effusion is situated immediately under the corneal conjunctiva, and is the consequence of a slow or long continued action. Hence it takes place in chronic ophthalmia; and in this form of opacity, enlarged blood vessels can always be distinctly traced running along the conjunctiva, and terminating in the speck. In the albugo, again, the effusion is betwixt the layers of the cornea, and is always the consequence of acute ophthalmia. There are, in this case, which is generally unaccompanied by inflammation, no enlarged vessels leading to the opacity. The leucoma or opacity arising from a scar involves the whole thickness of the cornea, as well as the conjunctiva covering it, and is formed by the general adhesion of the wounded surfaces and parts in immediate contact.

## TREATMENT OF OPACITY OF THE CORNEA.

In opacities of the cornea, the treatment must be adapted to the variety of the disease; but it may be observed with regard to opacities in general, that they are more easily removed when they are superficial, of a recent date, and in young subjects, than when they are deep-seated, of long continuance, and occur at an advanced period of life. As the nebula is always attended with enlarged vessels leading to the seat of the disease, and as it is also generally accompanied with a degree of ophthalmia, this variety of speck should be treated by dissecting off a portion of the enlarged vessels, close by the junction of the sclerotica and cornea, by means of small dissecting forceps and curved scissars, and then by subduing the inflammation. The inflammation, if it is of the acute kind, is best subdued by promoting the bleeding from the divided vessels, by means of bathing the eye with warm water, by the application of leeches, and by warm saturnine and opiate fomentations; but if it is of a chronic nature, the remedies best adapted are cold solutions of the sulphate of zinc, and the ointment of the red oxide of mercury. The introduction of an issue in the neck should also form a part of the treatment; and whether the speck be accompanied by acute or chronic inflammation, or whether inflammation exists at all, the patient should always be put on a course of calomel, as a means of exciting the action of the absorbents.

In the second species of the disease, the albugo, as the speck is always situated betwixt the layers of the cornea, it is difficult of removal in proportion to its being deep-seated. Mercury should always be had recourse to as one of the most powerful means of stimulating the absorbents, while the local treatment should consist in the application of the Ungt. Oxid. Hydr. R., the Vin.

Opii, and the introduction of the powder of calomel and sugar, recommended for ulcers of the cornea; or two or three drops of a solution of the oxymuriate of mercury, in the proportion of one grain of the salt to three ounces of water, may be daily put into the eye. By a course of mercury alone, and without any local application, I have succeeded in removing small opacities of the cornea, arising from repeated attacks of inflammation, after the opacity had continued upwards of ten years.

In those cases where the albugo does not yield to this treatment, it may be advantageous to puncture it repeatedly with a couching needle. Bidloo* rubbed the macula with a probe till it bled, and Mauchart† directs to perforate it with small holes by a needle; and the speck being thus destroyed, the cornea will exfoliate. The vulgar attempt to remove opacities of the cornea by friction with a gold ring, and I am told sometimes with success. Bidloo tells of a Jewish girl whose mother, by persevering in the practice of licking the cornea with the tongue, succeeded in removing a speck.

In leucoma, or where the opacity is produced by the scar of an ulcer or wound, it may be deemed incurable.

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* See Exercit. Anat. Chirurg.

† Mauchart, De Maculis Corneæ earumque operatione Chirurgica.

## STAPHYLOMA.

**Staphyloma** is an opaque projection of the cornea, a change of structure induced in consequence of high inflammation. It may arise from blows and wounds, sometimes follows smallpox, and is very frequently produced in infants by purulent ophthalmia. The tumor is at first soft like tallow, but gradually becomes hard, and acquires a whitish or pearl colour. Staphyloma is sometimes of a spherical, sometimes of a conical form, and often of great size, so as to project from betwixt the eyelids an inch or more. The size of the tumor prevents the shutting of the eyelids; and from the exposure there is a constant irritation and continual ophthalmia, which at length induces ulceration of the cornea. From the friction and general irritation, the cheek also becomes excoriated, and the disease by sympathy ultimately produces inflammation and ulceration of the cornea of the opposite eye. Complete staphyloma is always attended with a total loss of sight. The cornea becomes thickened as well as opaque, the anterior chamber of the aqueous humor is obliterated, and the parts are so completely massed together by the inflammation, that the iris adheres to the cornea, and sometimes the capsule of the lens to the posterior surface of the iris.

At an early period of the disease, the staphyloma might be mistaken for pus or for effused coagulating lymph, and if punctured with a sharp instrument, would feel soft like tallow; but in a more advanced stage, it becomes harder, and sometimes acquires a very firm consistence. In the progress of the disease, the blood vessels of the cornea become enlarged, so as to be very visible, and sometimes to bleed profusely.

## TREATMENT OF STAPHYLOMA.

THE older surgeons, conceiving the disease to be a dilatation of the coats of the eye, compared it with hernia and aneurism, and expected to cure it like these diseases, by support or compression. They pressed down the upper eyelid, and fixed it in that situation by a bandage, which could be gradually tightened, and into the bandage they put a plate of lead, or a piece of silver; but slight compression could be of no service, and if much pressure was employed, it would produce inflammation, and all its evil consequences. This would be the natural result of the mistaken principles on which the plan of cure of the older surgeons was founded.

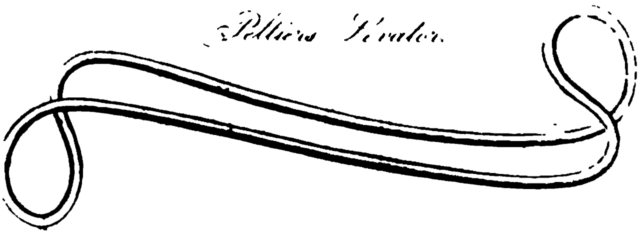
When we undertake the management of staphyloma, our object is not to restore sight, but to lessen the size of the tumor; for whilst the eye is in this diseased condition, it is subject not only to dryness of surface, but also to inflammation and continual pain, from exposure to dust and other foreign bodies, and to the irritation produced by the perpetual friction of the eyelids.

Richter's practice consisted in making a small issue in the cornea. This he did by dissolving a little caustic potash, then, dipping into the solution a hair pencil, he washed the most prominent and opaque parts of the tumor, which made the rest of it become dry and shrink. He occasionally renewed the application till the staphyloma wasted. Another practice, first recommended by Janin, and also adopted by Richter, consisted in dipping a small hair pencil in the liquid oxygenated muriate of antimony, with which he touched all the surface of the cornea, having at hand a sponge with warm milk, for the purpose of washing the eye as soon as the patient complained of pain and the tears began to flow. Richter applied the caustic daily, or every second day. On the fifth or sixth application, the staphyloma was gone, and in order to repress inflammation, he directed the eye to be bathed in the intervals with a saturnine solution. It was not intended by this practice to restore sight, but only to reduce those tumors which occasion great deformity, and excite perpetual irritation by friction of the eyelids.

It is an old practice to transfix the staphyloma with a ligature, separate the threads, and then tie on both sides; and Celsus speaks of a method recommended by the Greek physicians, Ætius and

Paulus, viz. to tie with two transverse ligatures when the tumor was large. When the staphyloma was so small as to cover a part only of the cornea, Gunzius put a thread through it, and dissected it away with a lancet-shaped knife. He often excised the whole tumor, including the cornea and iris, by which the humors escaped, the eye sunk, and he supplied its place with one made of glass. This is the very operation we now perform.

It has been already remarked, that the operation we have recourse to for the cure of staphyloma is employed, not with a view to restore sight, but to remove irritation and deformity. In performing it we place the patient in a chair, or if young lay him on a table; an assistant raises the upper eyelid, and keeps the eye steady by means of Pellier's levator,* while the surgeon, with the



Pellier's Levator.

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* In all operations on the eye, this instrument is preferable to the circular speculum in common use. It produces no irritation, while it keeps the eye equally steady as the speculum; when used it should always be applied to the outer part of the

fore and middle fingers of one hand, depresses the lower eyelid, and assists in fixing the eye. As soon as the eye is fixed, the surgeon takes Beer's cornea knife, and enters it near the external margin of the cornea, but a little farther out than the place where the knife is entered in the extraction of the cataract. He then carries the knife directly across the anterior part of the eye, bringing it out at the point opposite to that where he entered it. By pushing the knife forward, it will, from its form, cut itself out, and separate the lower segment of the tumor. The section of the upper portion should be immediately accomplished by the curved scissars, with the assistance of a hook or pair of small forceps, the assistant keeping the eyelids separate so as to enable him to effect it. As soon as the section of the cornea is completed, the humors escape, and the eye sinks in the orbit. The eyelids should be now closed, a bit of lint dipped in oil, or a pledget of simple ointment applied, and secured by a bandage. In a few days the eyelids swell considerably, and the eye inflames and suppurates. As soon as the inflammation commences, fomentations and warm poultices are the proper remedies; and when the suppuration is established, the inflammation abates, the wound granulates, and gradually contracting heals up in the course of a fortnight or three weeks, leaving a fleshy papilla in the centre, which some-

eyelid, and covered with a bit of crape, which prevents it from slipping.

times requires to be touched once or twice with caustic, so as to permit a glass eye to be fitted to the orbit.

## PROLAPSUS IRIDIS.

In consequence of wounds and ulcers of the cornea, the aqueous humor escapes, and by the action of the muscles on the ball of the eye, the vitreous humor and chrystalline lens press forward upon the iris. The resistance being taken off, the equilibrium is lost, and the iris protrudes through the opening in the cornea, forming what has been called prolapsus or procidentia iridis. From the high degree of vascularity of the iris, and from its extreme sensibility, the smallest protrusion of it is attended with the most poignant distress; the eye feels as if pierced with a sharp instrument, and is unable to bear the least light; and in a short time, like a strangulated hernia, the protrusion draws all the connecting parts into the most acute state of inflammation. The protrusion, at its commencement, is always of the natural colour of the iris; and the pupil is irregular and contracted; but, in consequence of the inflammation which immediately supervenes, the prolapsed portion adheres to the opening in the cornea, then becomes surrounded with an opaque circle, and is at last covered by a newly formed portion of conjunctiva, which destroys its sensibility. Prolapsus of the iris occurs more frequently as a consequence of ulcers than of wounds, because in the latter the edges of the wounded cornea can be placed in contact, and secured by a moderate degree of pressure, whereas in ulcers there is a loss of substance.

## TREATMENT OF PROLAPSUS IRIDIS.

When the prolapsus occurs in consequence of a wound of the cornea, the surgeon should endeavour immediately to replace the iris by means of the point of a fine bougie; but when it happens in consequence of an ulcer, it is needless to adopt this practice, because as the ulcerated edges of the cornea cannot be brought into contact, the aqueous humor will still continue to escape, and the disease be shortly reproduced. In this case, the inflamed surfaces of the iris and cornea will in a short time adhere, and then all that is requisite is to destroy the prolapsed or projecting point, because the pain and inflammation are chiefly kept up by the friction of the eyelids upon the protruded portion. Its removal might be effected by means of a pair of fine scissars; but it is better to have recourse to caustic, which has also the effect of exciting a healthy action, and disposing the ulcer of the cornea to heal. Whenever the projecting point of the iris is touched with the caustic, the patient feels extreme pain; but this abates as soon as the eschar is completely formed, which is in a few minutes. The application of the caustic should be repeated every third or fourth day, till the prolapsed portion of the iris is burnt down to a level with the cornea. In all applications of caustic to the eye, the organ should be immediately and repeatedly bathed with warm milk, to prevent the caustic acting on the sound parts.

## CLOSURE OF THE PUPIL.

Closure of the pupil is one of the evils resulting from inflammation of the iris, and may occur from whatever cause this inflammation proceeds; but its most common origin is to be ascribed to operations for the cure of cataract. Sometimes the pupil becomes obliterated very soon after an operation for cataract, at other times a long period of time elapses before this event takes place. In the former case, the symptoms of inflammation of the iris are strongly marked; in the latter, they are more obscure, and there is very little increase of the natural sensibility of the eye. The pupil gradually diminishes in size, till it is contracted to a small point, and the iris becomes immoveable and has a wrinkled or plaited appearance.

Obliteration of the pupil may exist without any other morbid affection of the eye; or it may be complicated with a change of structure in some other parts of the eye, such as an opacity of the lens or of the cornea, or an adhesion of the iris to the capsule of the lens, or to the cornea with a consequent obliteration of the anterior chamber. According to these circumstances, it will be more or less remediable by an operation. If the obliteration is complicated with disease of the vitreous humor or retina, there is total blindness; but if there is no disease of the eye except the closure of the pupil, the patient is always capable of perceiving the light; and this circumstance is a good criterion to judge of the success of an operation.

## ARTIFICIAL PUPIL.

When closure of the pupil is not complicated with any other disease of the eye, the defect may be remedied by the formation of an artificial pupil. Even when there exists at the same time a cataract, or a partial opacity of the cornea, vision may be restored; but when the anterior chamber of the aqueous humor is obliterated, when there are extensive internal adhesions, or when the vitreous humor is diseased, or the retina insensible, no artificial opening in the iris will be of service.

Although obliteration of the pupil be the most general reason for making an artificial opening in the iris, a similar operation may be required when an opacity of the cornea is so opposed to the pupil as to obscure vision in a considerable degree.

Chesselden was the first who performed a surgical operation to remedy the inconveniences arising from closure of the pupil; and since his time a variety of methods have been proposed to effect the same end. Chesselden's operation consisted in a transverse division of the iris. Towards the outer angle, he introduced a couching needle with one cutting edge, through the sclerotic coat, within two lines of the cornea into the posterior chamber of the aqueous humor; he then perforated the iris at its external edge, and carrying the instrument across the anterior chamber, till he reached the opposite margin of the iris, he turned its cutting edge backwards, and in withdrawing it divided this membrane transversely. Janin, who practised this operation twice, found in both cases that the transverse incision in the iris healed, and the pupil became obliterated as before. Warner and Wenzel have also, in several instances, failed, from the iris reuniting after the operation. This method of Chesselden's, therefore, fell into neglect, but was revived with some slight modifications, chiefly by Sir William Adams. Mr. Ware says, "that when the pupil has become closed after an unsuccessful operation of extracting the cataract, he has in several instances made a new pupil agreeable to Chesselden's mode of performing the operation, with the most perfect and striking success;" and from the cases adduced by Sir William Adams, it would appear that this operation is frequently successful, if the opening is made sufficiently large. Janin recommends the perpendicular division of the iris. He first divided the cornea, as in the extraction of the lens, and then with a pair of fine scissars divided the iris longitudinally near the nasal edge of the pupil. The reason that Janin assigns for the failure of Chesselden's operation and the success of his own is, that in Chesselden's the iris is divided in a direction parallel to its radiated fibres, in consequence of which the opening always closes, whereas in his own operation the fibres of this membrane are cut transversely, and hence the new-formed pupil not only remains open, but also enlarges.

Maunoir of Geneva has lately recommended the section of the iris in the form of the letter V, which he effects by opening the cornea, and then introducing curved scissars of a peculiar construction. In a few days the pointed part of the incised portion is retracted towards its base, and a pupil formed generally of the shape of a crescent.

The first operation, then, which was performed for the formation of an artificial pupil, consisted in the section or division of the iris; and this mode of operating was practised by Chesselden, Janin, Ware, and Adams. It has sometimes failed, in consequence of which, and more especially from having observed that the iris was easily separated from its ciliary connexion, which separation, on some occasions, had occurred accidentally, and supplied the place of the natural pupil, Scarpa proposed to form an artificial pupil, by detaching the iris to a certain extent from the ciliary ligament. He took a fine straight couching needle, and passing it through the sclerotic coat, about two lines from the external edge of the cornea, carried the needle through the posterior chamber of the aqueous humor till he reached that edge of the iris which was next the nose; then entering the point of the needle into its posterior surface at its upper part, he detached the iris from the ciliary ligament. This opening he enlarged, by pressing the point of the instrument downwards, and carrying it in a lateral direction towards the temple.

This detachment of the iris from the ciliary ligament is a simple operation, which has been effected frequently both by Scarpa and others with success; but independently of reunion sometimes taking place, it is attended with the three following manifest disadvantages: First, By entering the needle behind the iris, there is some danger of wounding the lens or its capsule, and thus giving rise to cataract where no opacity previously existed; secondly, If the point of the needle is brought so far through the nasal margin of the iris, as to present distinctly in the anterior chamber, the cornea will be wounded; and thirdly, As the separation of the iris is always effected at the inner margin, if there is any opacity of the cornea towards the inner angle, the new-formed pupil will be of no service. All these objections, however, may be obviated, by entering the needle through the cornea, and making the separation from the anterior chamber. Beer and Schmidt performed Scarpa's operation in this manner, and I believe it to be the preferable way of operating, when the object is to detach the iris from the ciliary ligament. This was at one time a favourite operation with Scarpa; but, from observing that the opening sometimes closed up, he afterwards recommended the operation of Maunoir.

A third operation for the formation of artificial pupil consists in opening the cornea, and cutting out a portion of the iris in the situation best adapted for the free transmission of the light. This operation was first proposed by the elder Wenzel, and then by the late Mr. Gibson of Manchester; since which time it has undergone various modifications, and is the operation now generally preferred. Mr. Gibson operated in the following manner:—By means of a broad cornea knife, he made a transverse opening in the cornea, about three lines in length, near to where it joins the sclerotica; through this opening the aqueous humor escaped, when the iris, being pressed forwards by the muscles of the eyeball, generally protruded. If it did not protrude sufficiently of its own accord, Mr. Gibson made such a degree of pressure on the eye as to cause it to present through the opening; and when it formed a little bag, of the size of a large pin's head, he snibbed it off with a pair of fine curved scissars. The iris immediately retracted within the eye, and the portion which had been cut off left an opening of a greater or less extent, and more or less circular, which supplied the place of a pupil.

Beer of Vienna performs this operation of excision by making an opening in the cornea one line in length, and close by the sclerotica. If the iris protrudes, he seizes it with a small hook; if not, he introduces the hook, and lays hold of its pupillary edge, which he pulls through the opening; and, by means of Daviel's scissars, cuts off a portion of such a size as he judges sufficient. The iris immediately retracts, and the portion which was cut off leaves an opening which supplies the place of the natural pupil. One advantage attending this method of operating consists in the surgeon always being able to lay hold of the iris at a point where there are no morbid adhesions, and where the opening will be most conveniently placed.

Although there is a variety of ways of forming an artificial pupil, many of the operations are essentially the same. They may, with great propriety, be arranged under three distinct heads; 1st, Those which are confined to the simple section or division of the iris; 2dly, Those which consist in the separation of the iris from the ciliary ligament; and 3dly, Those which embrace the excision of a portion of the iris. Each of these operations is applicable to particular cases, and may be occasionally practised with success; but the operation of most extensive application, and the one most successful in its result, appears to me to be that of Beer of Vienna.

It is worthy of remark, that after the formation of an artificial pupil, the iris continues insensible to the stimulus of light, and cannot be acted upon by belladonna. The new formed pupil, therefore, remains always of a determinate size.

## HYPOPION, OR ABSCESS IN THE ANTERIOR CHAMBER.

HYPOPION is a frequent consequence of acute internal ophthalmia. When the inflammation terminates in suppuration, the pus passes through the pupil into the anterior chamber of the aqueous humor. If the suppuration is extensive, the pus also occupies the posterior chamber, and, by preventing the rays of light from passing to the bottom of the eye, greatly obscures, or altogether obstructs vision.

There are two forms under which this disease appears. In the first, there is great vascular action, and the patient complains of a violent throbbing pain in the eye, occasionally shooting through the head, accompanied by frequent rigors, and other constitutional disturbance; during which, pus is perceived to be effused into the anterior chamber of the eye. If the inflammation continues to advance, the cornea becomes conical and opaque, and at length ulcerates; the contents of the ball are discharged, and the pain then gradually subsides. The ulceration of the cornea is sometimes followed by the escape of the aqueous humor only, and the protrusion of the iris; but most commonly all the humors are evacuated, and the sight is irrecoverably lost. In the second form of Hypopion, there is little pain or fever, and no distention of the eye, and the pus, which is in small quantity, is situated at the bottom of the anterior chamber, and seems to arise from internal ulceration of the cornea. With regard to the first species of Hypopion, or that which follows intense vascular action, it is worthy of remark, that during the violence of the ophthalmia, the Hypopion continues to increase; but that, as soon as the inflammation abates, it becomes stationary, and when the inflammation has altogether subsided, it generally begins to diminish.

## TREATMENT OF HYPOPION, OR ABSCESS IN THE ANTERIOR CHAMBER.

For the cure of Hypopion, it has been proposed to discharge the matter, either by making a puncture behind the iris, or by opening the cornea, as is done in the extraction of the lens. If there is present any inflammation, this will be a dangerous practice; for in consequence of the wound all the violent symptoms will be reproduced. A preferable practice, therefore, at least in the first instance, is to bleed, purge, blister, and have recourse to the strictest antiphlogistic regimen, which, while it subdues the inflammation, will also promote the absorption of the matter. By pursuing this practice, and trusting to time, pretty large collections of matter are frequently absorbed. The absorption may also be greatly assisted by putting the patient on a course of calomel. Both Mauchart and Scarpa relate several cases where Hypopion was cured by treatment, and the medicines employed were all such as prevent or allay inflammation. But if, instead of the matter diminishing in quantity, or remaining stationary, it should increase, and the ball of the eye become very turgid, with great pain, at the same time that the iris and pupil are invisible, it will be proper to discharge the matter by making an opening in the cornea, in the same manner as is done in the extraction of the cataract; otherwise the cornea will ulcerate, and there will be danger of the protrusion of the iris, escape of the humors, and a total loss of sight. When we are forced to open the cornea for the evacuation of the matter in hypopion, we should be careful to make no pressure on the eye, otherwise there will be great hazard of forcing out the lens. Richter has seen, that where the eye was opened in hypopion arising from a deep-seated ophthalmia, the lens has threatened to escape with the matter, and has pressed upon the pupil, as if it would force it; but that the flap in the cornea being clapped down and adhering, the eye has been completely restored without blemish, and without any defect in vision, which might have been expected to follow this dislodgment of the lens.

### HYDROPHTHALMIA, OR DROPSY OF THE EYE.

Dropsy of the eye, although in its commencement not a formidable disease, is in its progress as certainly ruinous to the structure of the organ, as any of the most malignant diseases with which it is liable to be affected. In hydrophthalmia, the eye becomes enlarged chiefly in the anterior chamber, and the cornea is greatly increased in its circumference. The sight is very little injured at first, but gradually grows worse, at length the aqueous humor and cornea become turbid and whitish, then succeeds pain in the eye, and afterwards headache, sometimes slight, but often very violent. When the eye has become very much distended, it begins to protrude from the socket, the sclerotic coat immediately encircling the cornea acquires a blue tinge, the iris at the same time becomes darker in its colour, appears to be situated farther back than usual, and the pupil remains dilated, although exposed to the strongest light, because from the great distension, the ciliary nerves are so much pressed upon as to induce paralysis of the iris.

This disease, after some months of increase, finally terminates in internal inflammation, complete confusion of the humors, suppuration and bursting of the coats of the eye, with partial discharge of its contents.

## TREATMENT OF HYDROPHTHALMIA.

In the treatment of dropsy of the eye, Nuck, Mauchart, and some other writers, recommend simple puncture. If there be a weak and projecting point in the cornea, or if this coat is already opaque, it may perhaps be advisable to choose this as the place of puncture. Mauchart, however, advises the eye to be punctured in the sclerotica, at the place where the couching needle is commonly entered, or, when the vitreous humor is diseased, a little farther back. These seem to be the proper places for the operation.

In puncturing, the patient should be placed as in the operation of couching, and the eye fixed by a moderate degree of pressure upon the eyelids with the fingers. A lancet-shaped needle, about a line and a half in breadth, and slightly concave, should then be entered with its concave surface pointing forwards through the sclerotica, near to the edge of the cornea, and passed behind the iris into the posterior chamber. The aqueous humor will then run along the instrument, and, if the head be reclined backwards, will, by a slight pressure, be readily evacuated from both chambers. As soon as the aqueous humor is evacuated, the eye will retire within the orbit. A bit of lint dipt in cold water, or in a saturnine solution, is now to be applied to the eyelids, and the usual remedies are to be employed to repress inflammation.

This palliative operation of puncture may be repeated as occasion requires. Though it should not preserve the sight, it will be of great utility, by preventing the eye from acquiring a great bulk, and save it from total disorganization, or from becoming cancerous.

Mr. Ford, in the year 1781, proposed a method of cure by seton, a practice which had been previously recommended both by Woolhouse and by Mauchart. All the cases of the disease which presented themselves to Mr. Ford, were accompanied with opacity of the cornea, so that the sight was irrecoverably gone. He recommended the cure by seton to be practised only in such cases, with the intention of remedying the deformity and distress arising from the increased bulk of the eye.

Mr. Ford performed the operation in the following manner. The patient being seated as for couching or extracting the cataract, he took a seton needle, armed with six threads of sewing silk, and passed it from the external angle of the eye, about a quarter of an inch from the edge of the cornea, through the posterior chamber, bringing it out on the inner side, at an equal distance from the cornea. Care was taken in fastening the threads not to draw them too tight, as they would be apt in that case to cut through the cornea before the cure was completed. Inflammation and swelling of the eye and eyelids to a certain extent, accompanied by fever, succeeded to the operation; but by bleeding, purgatives, and an antiphlogistic regimen, these were in general easily subdued.

When the inflammation abated, which was commonly about the eighth or ninth day, Mr. Ford removed some of the threads; and the eye retiring within the orbit, the patient was greatly relieved from those distressing symptoms with which he was before afflicted. The remaining threads of the seton were retained in the eye for a month before they were removed; but after the first inflammation had subsided, they did not excite much irritation.

As in hydrophthalmia the sight is irrecoverably lost, Scarpa recommends the same operation which he practises for staphyloma. This consists in the excision of the cornea, by which the humors are evacuated; the eye then collapses, and the wound heals by suppuration and granulation.

## CATARACT.

An opacity of the crystalline lens, or of its capsule, constitutes the disease called the cataract. The opacity is sometimes entirely confined to the lens, sometimes resides solely in the capsule, and not unfrequently both the lens and capsule are affected. According to these various states of the disease, it is more or less difficult of cure.

It is to the moderns that we are indebted for a knowledge of the real seat of cataract; and it is shadow of the iris upon the lens, now rendered visible from its opacity.*

Besides being sometimes congenital, cataract is occasionally produced by blows or wounds. It has been observed frequently to occur in females about the cessation of the menses, and in those whose occupations lead them to be exposed to a strong and long continued heat, such as glass-blowers, brass-founders, and blacksmiths; but, in the greater number of cases, the disease can be traced to no distinct cause, and seems to occur spontaneously. Weller believes that it often arises from an inflammation of the lens. Richter ascribes its existence sometimes to scrophula, syphilis, or gout. Richter, Janin, Maitre Jan, and Sir William Adams, think there is an hereditary cataract; and this opinion is supported by the cases which fell under their observation. From the frequency of its occurrence in the decline of life, more especially among the lower ranks of society, and from one eye being seldom affected without a corresponding affection of the other, or at least a similar state occurring soon after, cataract would appear to be most commonly a general and not a local disease.

Cataracts are of various colours and consistence. They exhibit every shade, from a dark green or yellow, to a pure white; but the most common is that of a bluish white. It is, however, worthy of remark, that although the cataract appear white while in the eye, after extraction it is generally found to be of an amber colour.

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* See Weller on the Diseases of the Human Eye, translated by Dr. Monteith of Glasgow. Vol. i.

With regard to the consistence of cataract, there are three states under which it presents itself: hard, soft, or fluid. The marks which authors have given to judge of this consistence, are by no means certain. The incipient cataract is often hard, while that of many years standing is frequently found to be quite soft. Cataracts have received different names, from their firmness or softness of texture. It is particularly requisite to attend to their differences, and to endeavour to point out those criteria which seem best calculated to enable us to form a correct judgment of the case, as our method of operating must be greatly influenced thereby. 1st, When the lens is firm and hard, and does not yield under the needle, it is called a firm or hard cataract; 2d, When entirely dissolved and of the consistence of cream, a fluid or milky cataract; 3d, When of a consistence betwixt the hard and fluid cataract, or of a gelatinous or curdy texture, it is named the soft or caseous cataract; 4th, When the opacity resides in the capsule, it is termed a capsular cataract; and, lastly, When this opacity occurs after the lens has been dislodged by an operation, it is denominated a secondary cataract.

Although we have observed that there are no certain marks by which one cataract can be distinguished from another, previous to an operation, still Pott, Richter, Travers, and some other writers have enumerated certain signs which, in many cases, are found to hold true.

When the cataract is hard, it is generally of a dark grayish or brown appearance, and always small, leaving a distinct space betwixt it and the margin of the pupil; when there are no adhesions, the iris is free, and contracts readily, and when the pupil is dilated, a dark-coloured circle is perceptible round its margin. In this case, the patient is not entirely blind, but is capable of discriminating bright colours, and experiences a considerable increase of vision, from the application of belladonna to the eye.

When the cataract is fluid or milky, it is large and white, sometimes crossed in various directions with coloured streaks, which frequently change their form and situation, particularly when the eye is pressed upon. The opacity is always close to the pupil, and appears to be situated nearer to the cornea than the hard cataract, a circumstance arising from the weight and size of the lens pressing forwards the iris. The pupil contracts very slowly, there is no dark-coloured circle betwixt it and the lens, and, from the fluid gravitating downwards, the lower part of the cataract is more opaque than the upper. In this case vision is very indistinct, and is but little, if at all increased by the application of belladonna.

The soft or caseous cataract is said to be still larger than the fluid. It is accompanied by the same sluggish action of the pupil, and other marks which characterize the fluid cataract, except that instead of being intersected by bands or streaks, which change their place upon motion or pressure, the surface is not uniform, but has a broken appearance, and is generally of a bluish white. This is the species of cataract most frequently met with in practice.

When the cataract is capsular, its surface is irregular, and spotted with white specks, or has a mottled appearance. Both Mr. Saunders and Mr. Travers have remarked, that in the congenital and fluid cataract, the capsule is generally opaque.

Independently of these marks, which have been thought to characterize the various species of cataracts, inferences with regard to their texture may be drawn from the age of the patient. The crystalline lens at birth is no harder than jelly; but as we grow older, gradually becomes firmer. In every stage of life, it is always firmer in the centre, and softer at the circumference. When it becomes opaque, we generally find the cataract to be of that consistence which the healthy lens would have been at the same period of life; hence, congenital cataract is generally fluid, the cataract of early life soft, that of middle age firm, and that of old age hard.

When the existence of a cataract is once ascertained, as well as its seat and consistence, the next object of the surgeon is to endeavour to discover if it is complicated with any other disease of the eye which might render an operation useless.

The diseases with which cataract is most frequently combined are amaurosis or a paralytic state of the retina, obliteration of the pupil, and an adhesion of the lens or of its capsule to the iris. It is sometimes very difficult to discover if there be any disease of the retina, for, although, it has generally been imagined, that a paralytic state of this nervous expansion is indicated by dilation of the pupil and immobility of the iris, accompanied by headaches and flashes of fire from the eye, these marks are so uncertain that no reliance can be placed upon them. The retina may be paralyzed when the iris retains its sensibility, and the iris may be insensible, as after the application of belladonna, when the retina is alive to the stimulus of light, although they are no doubt most frequently paralyzed together. Many cases of amaurosis have occurred, where the pupil had its natural appearance, and readily dilated and contracted according to the light to which it was exposed, so that these appearances can be esteemed no criterion of the state of the retina. The true marks of the sensibility of this membrane are the sense of light, and the perception of the shadow of the hand or any large object, when drawn across the eye. In those cases where cataract is complicated with closure of the pupil, the existence of the latter disease becomes evident upon examination; and, if there are no adhesions, an artificial pupil may be readily formed, after which the cataract may be removed by an operation. When there are adhesions betwixt the cataract and the iris, their existence may be ascertained by the irregular form of the pupil, upon being exposed to the action of the light, and by its state of dilatability by belladonna. A complication of disease is always unfavourable for operation, and when the retina is paralysed, no operation will restore sight; but when the patient sees the light, when the iris readily dilates and contracts, when there is no irregularity in the pupil, and when the cataract, instead of arising from external injury, occurred spontaneously, we operate with great assurance of success.

To enable the surgeon to form a judgment of the species of cataract, and to ascertain the existence of any other disease, there is no better help than the application of belladonna; and previous to an operation, this mode of inquiry should never be omitted.

## TREATMENT OF CATARACT.

No surgeon of the present day has any faith in medicine, applied either externally or internally, for the cure of cataract, but always has recourse to an operation; and his great difficulty is the selection of that which is the most applicable, there being various opinions on this subject. The opacity of the lens, from preventing the rays of light passing on to the retina, is the only obstruction to vision; and therefore removing this opaque body from behind the pupil or from the eye, is the cure; an object which may be effected in five different ways. 1st, The lens may be removed from the axis of vision, by depressing it with the point of a needle,—the operation of couching. 2d, It may be altogether removed from the eye by making an incision in its coats,—that of extraction. 3d, The diseased lens may be destroyed by cutting it in various directions with a sharp instrument,—an operation called division. 4th, It may be reclined, or thrown backwards into the vitreous humor,—which is termed reclination. And, 5th, It may be dislocated or dislodged from its bed, and forced through the pupil into the aqueous humor,—which operation may be called dislocation.

All these operations may be performed by passing the instrument, either through the cornea, or through the sclerotica behind the iris. But before I proceed to the consideration of any of them, I think it right to direct the attention of the younger part of the profession to a point on which they are apt to form very erroneous conceptions. From the apparent delicacy of the eye, and from the quickness with which itinerant oculists operate, the young surgeon is apt to imagine that all operations on this organ should be executed in a very short space of time, more especially that of couching. He is therefore led to perform it in a quick and hurried manner; which is not only a frequent cause of failure, but greatly endangers the organ. Instead of a few seconds, an instrument may be retained many minutes in the eye; and all that is required is steadiness and a knowledge of the anatomy. If the operator possess these qualifications, he may use much greater freedom with it than is generally imagined.

Couching.—Couching, or depression, was the earliest operation performed for the cure of cataract; and this method was practised long before surgeons had right conceptions of the true nature of the disease. The aim of the operator in couching the cataract, is to remove it from the axis of vision, and carry it downwards and backwards into the substance of the vitreous humor. In effecting this, the needle has generally been passed through the sclerotic coat, and behind the iris; but, of late years, some continental surgeons have recommended the lens to be depressed through the cornea, previously dilating the pupil by means of belladonna. There is no doubt that couching may be performed by carrying the instrument through the anterior and transparent part of the eye; but neither can the lens be so effectually depressed, nor the iris and ciliary processes be so safe, as when the needle is passed through the sclerotic coat. There are cases, besides, where the pupil cannot be completely dilated, and in which, therefore, the corneal operation is inapplicable; although I conceive that in all the operations for cataract, where the object of the operator can be as completely accomplished by passing the needle through the cornea, it is the preferable method, because fewer important parts are involved. In couching, however, as this passage of the instrument through the cornea does not give the needle so complete a command over the cataract, as when carried through the sclerotica, the posterior mode is more advisable.

In depressing the cataract, the part of the eye which is most apt to be wounded or torn, is the ciliary processes; and as this part of the structure is both very sentient and vascular, great care should be taken to avoid it. The earlier operators, Brisseau, Albert, Gorter, Junker, and Gunzius, entered the needle very far back. Gunzius directs it to be entered three lines behind the cornea, to avoid the ciliary processes, and this was also the practice of Heister; but the more modern operators puncture much nearer the cornea. Sharp directs to enter the needle something less than one-tenth of an inch from the cornea; St. Ives about half a line, or at most a line's distance; Scarpa rather more than a line; Sir William Adams a line; Beer of Vienna not nearer the cornea than a line, and not farther back than the eighth of an inch; and Mr. Hey of Leeds at so small a distance as one-sixteenth of an inch. If the needle is entered so close to the margin of the cornea, as these writers direct, it is hardly possible to avoid wounding the ciliary processes. St. Ives admits that the lower part of the processes is torn; but if any freedom be used with the needle, the whole circle will be torn. The wound of this part of the eye is apt to be followed by iritis, closure of the pupil, paralysis of the iris, and other bad consequences. I apprehend, therefore, that it is advisable to enter the needle rather more than two lines behind the cornea; by which method the lens will be carried downwards behind the ciliary processes, and this part of the structure remain uninjured. It is admitted, that by puncturing at the point now recommended, the instrument must pass through the retina; and this, being supposed to be followed by excruciating pain which in some cases can never be removed, by vomiting difficult to stop, and by amaurosis, has been stated as an objection against entering the needle far back. But these symptoms, as consequent upon couching, are not taken notice of by the earlier operators, who must always have wounded the retina; and I have on many occasions punctured at least three lines behind the cornea, without once witnessing any of them. I should be inclined to ascribe such symptoms to wounds of the ciliary nerves rather than of the retina, and I accordingly perceive, that in two of the cases recorded by Mr. Hey, there did succeed sickness at stomach, and great pain in the eye and forehead, which must be so accounted for, as he entered his needle nearer to the cornea than any other operator.

While the surgeon enters his needle at a sufficient distance from the ciliary processes, he should also be careful to puncture below the equatorial diameter of the pupil, to avoid wounding the long ciliary artery. Mr. Sharp and some other surgeons direct to enter the needle on a line with the middle of the pupil; but this direction is manifestly improper. The long ciliary artery runs betwixt the sclerotic and choroid coats, over the convexity of the eye, nearly on the same parallel with a line drawn transversely through the middle of the pupil; and if the needle be entered on this line, there will be a risk of transfixing the vessel, and causing such an effusion of blood as will obscure the pupil, and prevent the operator from tracing the motions of his needle. He should therefore puncture below this line in the lower part of the eye, by which means he will not only avoid wounding the ciliary artery, but have a greater command in depressing the lens.

Having made these few preliminary observations with regard to the place of puncture, I shall now detail the several steps of the operation. In all the operations for cataract through the sclerotica, the patient should be seated considerably below the operator, with his head inclined a little backwards; whereas, in all those through the pupil, the head should be placed nearly in an upright posture, while he is still seated lower than the surgeon. In couching, one of the best situations for the patient is on the floor. The assistant should be seated upon a chair of the ordinary height, and the patient so placed betwixt his legs that the light may fall obliquely upon the eye to be operated on. The sound eye being now covered to prevent corresponding motions in the diseased one, the patient should be desired to recline his head backwards upon the breast of the assistant, who sits forward to support it, and who places one hand under the chin, while, with the other, he raises the upper eyelid by means of Pellier's levator, and fixes the eye by a slight pressure. The surgeon now places himself before the patient upon a low seat, and plants his foot upon a stool, of such a height as to raise his knee upon a level with the patient's chin. He now takes the couching needle, and holding it as he does a pencil or writing pen, leans his elbow upon his knee, and then supports his hand by resting with the ring and little fingers upon the patient's cheek, recollecting that if he is to operate on the left eye, he must use his right hand, or if the right eye the left hand, as the needle is always entered from the external canthus. The surgeon may employ either Scarpa's or Hey's needle, delineated in Plate XIII. but the preferable one is that of Scarpa, because it makes a small wound, and, from the curve at its point, takes a firm hold of the lens, and is not so apt as the other to slip, while it enters the coats of the eye with equal ease. Previous to entering the needle, the surgeon, with the fore and middle fingers of the disengaged hand, presses down the lower eyelid, and assists in fixing the eye.

Things being thus arranged, the patient is desired to turn his eye towards his nose, so as to expose a great portion of the white at the outer part, and the surgeon now enters his needle below the equatorial diameter of the eye, at the distance of two lines and a half from the temporal margin of the cornea. The needle must be entered with a sort of plunge, otherwise, from the toughness of the sclerotic coat, the eye will be carried towards the nose before the instrument, which will then enter with a start, and be apt to injure the organ. If Scarpa's needle be used, the point must be directed backwards, when its convex surface will be towards the operator. After the instrument has fairly entered, it must be carried in this direction through the anterior part of the vitreous humor towards the centre of the eye, till it reaches the posterior surface of the lens. The surgeon turns the needle so as to place its convexity upwards, and elevating its point, he, by carrying the handle towards the temple, directs the point through the upper part of the lens till he fairly transfixes it, when he will see through the pupil the needle in the posterior chamber of the aqueous humor. When the lens is transfixed, before the surgeon proceeds to depress, he should, in order to lacerate the capsule, move the point of his needle backwards and forwards to a small extent, taking care not to injure the iris. The free laceration of the capsule both favours the dislodgement of the lens, and tends greatly to prevent the formation of secondary cataract. If the lens is not of a very firm consistence, the needle will pass easily through it; if very firm, this will not be the case, but it still will enter into its substance. When the point of the needle is fixed in the lens, the surgeon should elevate the handle of the instrument till he brings it to the horizontal line, which will carry the cataract downwards, and, while thus depressing, he should at the same time direct it backwards, and lodge it in the vitreous humor. He should now withdraw the needle a little, but not entirely, from the eye, till he ascertains if the lens is fixed. If it does not rise again, he should withdraw the needle altogether, close the eyelids, apply a bit of lint dipped in cold water or a saturnine solution, and secure it with one turn of a roller.

By dilating the pupil with belladonna previous to the operation, there will be less risk of injuring the iris.

The operation of couching is applicable only to those cases where the lens is either hard, or at least of a pretty firm consistence. If the cataract be fluid, the capsule is no sooner punctured than its contents become diffused through the aqueous humor, which is thus rendered so turbid as to obscure the pupil, and prevent the point of the needle from being seen. In this state of the cataract, the capsule is always opaque; the surgeon should therefore lacerate it freely although cautiously, in different directions, before he withdraws his needle, so as to destroy its texture. In a short time it will be absorbed, and the aqueous humor become clear, so as to accomplish the object aimed at by depression.

Couching very often does not succeed; but the operation may be repeated again and again without either pain or danger. If we fail, from adhesion, or any other cause, in our first attempt to dislodge the cataract, it will be better not to persevere too long, but to desist, and repeat the operation after an interval of time. As examples of the frequency of repetition, and ultimately with success, I may adduce Mr. Hey's cases, which indeed are chiefly remarkable on this very account. When the operation fails, from whatever cause, the surgeon should be careful that all inflammation be completely subdued before he makes another attempt.

Extraction.—The operation of extraction is of a much later date than that of couching. It was first performed in 1747 by Daviel, who, having sometimes observed the lens to start from under the needle, and get through the pupil into the anterior chamber, inferred the safety and practicability of extracting it by opening the cornea. The operation was perfected by Wenzel. Extraction may be performed either through the sclerotica or cornea, but, in the first of these situations, so many important parts of the organ are involved as greatly to endanger the structure; the surgeon should, therefore, when he performs this operation, extract through the cornea.

The preliminary steps of placing the patient and surgeon should be the same as in couching, except that the patient should not be seated on the floor, but on a low chair, with his head nearly upright. The assistant raises the upper lid of the eye to be operated on, which he supports either with his fingers, or with Pellier's levator. The patient should then be desired to turn the eye a little upwards and outwards, so as to expose a great proportion of the white at its inner angle. When the eye is in this situation, it should be fixed by the surgeon pressing down the lower eyelid with the fore and middle fingers of the disengaged hand, making at the same time a proper degree of pressure at its inner part, while the assistant does the same with the upper eyelid. When the eye has become fixed, the operator enters the point of the knife with its edge downwards at the outer part of the cornea, just before it joins the sclerotica, a little above the transverse axis of the eye. He carries the knife forwards through the anterior chamber, till its point appears at the inner margin of the cornea, through which he pushes about one-third of the blade. The aqueous humor will not escape previous to the knife being brought through the opposite side of the cornea, if the instrument is properly made; for as the blade should always be broader than half the diameter of the cornea, and increase in thickness towards the handle, it will completely fill up the opening, and prevent the escape of the humor. As soon as the punctuation is completed, all pressure must be removed from the eye, otherwise the aqueous humor now escaping, the iris will be forced forwards, and be in danger of falling under the edge of the knife. The pressure being then removed, and the eyelids held asunder, the aqueous humor will flow out, the cornea of course will become flaccid, and by the blade of the knife being merely carried straight forwards, while its handle is inclined towards the temple to keep its point free of the nose, it will cut its way out, and separate a little more than half the cornea from the sclerotica. The knives of Beer and Richter possess in this respect a superiority over those of Wenzel and Ware; for, when operating with either of the latter, the instrument, after the punctuation is completed, must be carried downwards to effect the section of the cornea. After making the incision of the cornea, the operator should allow the upper eyelid to drop, and at the same time cover the eye with his hand, to obstruct the light and to dilate the pupil.* In about a minute he raises the eyelid, and opens the flap of the cornea with a probe, when he should introduce through the opening, and through the pupil, a lancet-pointed cataract needle, with which, by repeated cuts in various directions, he not only opens but destroys the anterior part of the capsule of the lens. This tends greatly to prevent the formation of secondary cataract. Gentle pressure is now to be applied to the eye, when the lens will force itself through the pupil, and be expelled. When the lens is of a soft consistence, it sometimes breaks, leaving fragments in the eye; and as it is thought that these fragments will obscure vision, we are directed by some writers to remove them by the introduction of a small scoop called a curette; but as they will float through the pupil into the anterior chamber, and be absorbed, there seems little necessity for this part of the operation. After the extraction of the lens, the edges of the cut cornea must be laid in accurate contact, the eyelids closed, and the whole secured by the moderate pressure of a compress and bandage, while the patient is kept in a horizontal posture to prevent the escape of the humors. The aqueous humor continues to flow for two days, when the wound generally heals.

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* The pupil may be dilated by belladonna previous to the operation; but Dr. Monteath, the translator of Weller, condemns this practice, as he says, the iris, from being paralysed, is apt to fall betwixt the lips of the wound in the cornea.

Although extraction was the favourite operation of Wenzel and Ware, it is liable to so many mischances, that it appears to be by no means adapted to general practice. 1st, If the aqueous humor should escape before the knife has been passed through the opposite side of the cornea, any undue pressure of the operator or his assistant, or even the action of the muscles of the eye, will push forward the iris, and make it fall under the edge of the knife. When this accident is observed, the surgeon should immediately press with the point of his finger upon the cornea, which will force back the iris, and enable him to complete the section. The iris is also apt to be wounded when convex. 2d, The vitreous humor sometimes follows the lens; and when so diseased as to be more fluid than natural, which is not unfrequently the case, all the care of the operator will not be able to prevent it. This is a material objection to extraction. The vitreous humor may also be forced out, in consequence of a severe fit of vomiting, which sometimes follows the operation. 3d, After the extraction of the lens, the iris has on some occasions been entangled betwixt the lips of the wound, by which it has been involved in the cicatrix, giving rise either to staphyloma of this membrane, or to a partial or total obliteration of the anterior chamber, and consequent diminution or loss of vision. 4th, From the exposure of the internal parts of the eye, or from the violence used in forcing out the lens, extraction has not unfrequently been succeeded by an inflammation, which has terminated in suppuration, closure of the pupil, or secondary cataract.

Baron Wenzel was the great advocate for extraction, and gives a more favourable account of the operation than any other writer; yet he not only informs us of the failure of other oculists, from a variety of causes, more especially of the escape of the vitreous humor, but of this accident having sometimes occurred even in his own practice; so that I am fully convinced that extraction is not the operation for common use. But if extraction is to be adopted, I would propose reversing the steps of the operation, by which the wounding of the iris may be avoided, the escape of the vitreous humor prevented, and the removal of the cataract in every respect rendered easier. The lens may be first dislodged and brought into the anterior chamber of the aqueous humor, in the manner to be pointed out under Dislocation; and when this has been effected, an opening may be made in the cornea, and the cataract extracted.

DIVISION.—This operation for the cure of cataract is of a very recent date, when compared with that of couching or extraction; and may be performed, like the other operations, either through the sclerotica or cornea. It is preferable through the cornea, because fewer parts are involved; there is consequently less danger of injuring the eye; and the surgeon, from having a more direct view, is better enabled to guide his needle. The object of the operation is to break down the lens with the point of a needle, by which its organization is so destroyed, that it is removed from the axis of vision by absorption. To effect this without endangering the iris, the pupil must be dilated by belladonna. When the dilatation is complete, which is generally the case an hour after its application, the patient and surgeon are to be seated as for extraction. An assistant is to raise and support the upper eyelid with his fingers, or with Pellier's levator, while the surgeon pulls down the lower lid with the fore and middle fingers of his left hand. It is necessary to fix the eye; but neither the surgeon nor assistant should employ much pressure, because if the aqueous humor should escape by the side of the needle, as soon as the capsule is cut the pressure will force the lens into the anterior chamber, and prevent the operator from accomplishing its free division. The division of the lens may be effected by any sharp-pointed needle; but that which seems best adapted for this purpose is delineated in Plate XIII. It is about an inch in length, lancet-shaped at the point, and cuts on both sides to the extent of a little more than a line, after which it should be round, to permit it to be turned in all directions in the eye. Care should be taken that the rounded part of the needle should be larger than the point, and increase in thickness as it approaches the handle; which formation of the needle fills up the opening, and prevents the escape of the aqueous humor.

When the patient, the surgeon, and his assistant, are placed, and the eye fixed as directed, the surgeon, resting his needle upon the fore finger of his left hand, which is applied to the lower eyelid, pushes it along, and punctures the cornea in the middle of its lower part, about a line above its junction with the sclerotica. He should perforate the eye, with the edges of the needle pointing upwards and downwards, then, carrying it through the centre of the pupil, enter the capsule of the lens at its upper part; and, after making one perpendicular section, by turning the needle in all directions, freely divide both capsule and lens. Many of the fragments may be brought by the flat side of the needle into the anterior chamber, where they will be more readily absorbed; but, as much time is frequently required to effect this, and as the iris may be injured in the attempt, it is preferable to allow them to remain in situ, and withdraw the needle. If the lens has been freely divided, many of the portions will float through the pupil, or, at all events, its organization will be so destroyed, that in a short time it will disappear.

Division is one of the most simple methods practised for the cure of cataract, and, when done through the cornea, is the operation called by the German surgeons keratonyxis. If the operation should fail, it may be repeated without either danger or pain; and it possesses this claim to the notice of the young surgeon, that he may employ his right hand for both eyes, which is an advantage to those who are not ambidexter. But division is not successful immediately, the patient not recovering his sight for some time, and is only suited for those cases where the cataract is either soft or fluid. It was a favourite operation with Mr. Saunders in congenital cataract, and he performed it with remarkable success.

**Reclination.** — Reclination is an operation which has been lately proposed, and chiefly practised by the German oculists. It may be performed either through the cornea or the sclerotica, and differs from depression in this respect particularly, that while the lens, in the latter, is carried downwards and backwards, so as to be lodged in the lower part of the vitreous humor, in reclination it is thrown directly backwards into the centre of this humor. The displaced lens is so situated, as to lie with its upper edge backwards, its lower edge forwards, its posterior surface downwards, and its anterior surface upwards. Whether reclination be performed through the cornea or the sclerotica, the pupil should be dilated by belladonna, which renders the iris less liable to be injured. This dilatation is particularly necessary, if the operation is performed through the cornea, otherwise the surgeon has not room to throw back the lens, and, in attempting to do so, must wound the iris. If the reclination is performed through the pupil, the patient should be placed as in the operation for extraction or division, with his head nearly upright; but if it is done through the sclerotica, the best posture is the floor, as in couching, with the head inclined backwards. I conceive the preferable operation to be the posterior, or that through the sclerotica, because the surgeon has a greater command over the lens, and can therefore more easily throw it backwards. The iris, too, is in less danger than in the anterior operation; and if the surgeon enters his needle about two lines and a half behind the cornea, as in couching, the ciliary processes will be safe. The steps of the operation are the same as in couching, only the lens, instead of being carried downwards and backwards, is thrown directly backwards; and it is thought that in this case there will be less risk of injuring the retina.

Reclination differs little from depression. Both operations possess the same advantages, and are liable to the same objections; they are applicable only to the hard or firm cataract, and it seems to me of little moment which of the two the surgeon performs.

DISLOCATION.—Dislocation is the fifth operation which may be performed for the cure of the cataract. It consists in dislodging the lens from its seat in the vitreous humor, and forcing it through the pupil into the anterior chamber, where it may be left for absorption, or immediately removed from the eye by opening the cornea. In this last case, the operation falls more properly under the head of extraction than of dislocation. The principle of dislocation is not the result of reasoning merely, but of experience; as it has been ascertained that a displaced lens, wherever it may be situated, and whether hard or soft, will, through time, be absorbed, though the celerity with which the absorption takes place will no doubt depend upon the consistence of the cataract and the powers of the constitution.

Dislocation, like all the other operations for cataract, may be performed either through the sclerotica or cornea, but the former of these is generally adopted. I conceive the latter, however, to be the preferable operation, because, in performing it, there is neither pain nor risk of injuring the ciliary processes or iris, or deranging the vitreous humor, retina, or any important part of the organ; and the object in view is as easily effected as when operating through the sclerotica. Whichever of the operations is performed, the pupil should be dilated by the application of belladonna an hour before the needle is introduced. If the surgeon means to perform the posterior operation, every thing is to be arranged as in couching, the eye perforated in the same place, and the capsule of the lens lacerated in the same manner. Then, instead of laying hold of the cataract at its upper part, and carrying it downwards and backwards into the vitreous humor, he should bring the needle to a horizontal line, and press upon the posterior surface of the lens, by carrying the handle of his needle towards the temple; when, if there be no adhesions, he will generally be easily able to bring the lens into the anterior chamber. In forcing the lens through the pupil, the surgeon will have a greater command, and be in less danger of injuring the eye, by employing a flat needle, such as Mr. Hey's, which, in this case, is preferable either to a round one, or to Scarpa's.

I have already said, that the most simple manner of dislocating the lens, and bringing it into the anterior chamber, is, by passing the needle through the pupil; and, in this operation there is no possibility of doing harm, as the cornea and lens are the only parts necessarily involved in it. I have often done it in the following manner: the patient being placed, and the eye fixed, as for division, I take a needle nearly similar to the one recommended in that operation, Plate XIII. Fig. 3, with this difference only, that it should decrease in thickness as it approaches the handle, the object of the operation being to discharge the aqueous humor while the instrument is in the eye. I enter the needle at the lower part of the cornea, carry it through the pupil, and freely divide the anterior part of the capsule of the lens, by cutting in different directions. While I am dividing the capsule, the aqueous humor flows out by the side of the needle, and the cornea becomes flaccid. I now withdraw the needle slowly from the eye, and, in doing so, press gently on the lower eyelid, while the assistant employs a similar degree of pressure on the upper. By this compression of the eyeball, the lens passes easily through the pupil into the anterior chamber, and occupies the place of the discharged aqueous humor.

This is a very simple process, but I have observed, that, after the removal of the aqueous humor, the lens has sometimes resumed its original seat, and the absorption then went on so very slowly, that it was necessary to repeat the operation. Notwithstanding its simplicity, however, it is liable to a material objection. If the lens is bulky, and more especially if it is hard, it so presses on the iris as to cause great pain, and excite inflammation of that membrane, which is apt to be followed either by suppuration, or by effusion of coagulating lymph and closure of the pupil. These bad consequences may no doubt be in a great measure obviated, by keeping the pupil permanently dilated, by belladonna applied to the eye twice in the twenty-four hours, while the patient is confined to bed, and put upon a course of calomel, which will not only assist the absorption of the displaced lens, but prevent the inflammation of the iris terminating in adhesion.

In the treatment of cataract, a prevailing error has been the indiscriminate application of the same operation to every species of the disease. Thus Wenzel and Ware always extracted, Scarpa and Hey invariably recommend couching, and Sir William Adams has recourse to division, even when the cataract is hard. All the operations are valuable, and the great cause of their frequent failure is their misapplication. Thus, as it is difficult to divide a hard cataract, and almost impossible to couch a soft one, the operation should be adapted to the consistence of the lens, and to the nature of the cataract, whether lenticular or capsular. A hard cataract should be couched or extracted; a soft cataract cut in pieces or divided; a fluid cataract punctured, and the capsule destroyed; and a capsular cataract lacerated or broke up.

## AMAUROSIS OR GUTTA SERENA.

Amaurosis is a diminution or an entire loss of sight, arising from paralysis of the retina, or of the optic nerve. The disease is in general characterized by a large black pupil, and an immoveable iris, with a degree of strabismus; but the dilatation of the pupil, and the immobility of the iris, are not constant symptoms. There are cases on record where the amaurosis was complete and incurable, and yet the pupil dilated and contracted according to the degree of light to which it was exposed; and so far from a dilated and immoveable pupil being a constant attendant on amaurosis, we sometimes find the pupil more contracted than natural, while on other occasions it has its usual appearance; although there is no doubt that in the most common forms of the disease, there is both dilatation and immobility. I know of no state of the pupil which can point out the particular cause to which the amaurosis may be imputed, but I believe that it is always dilated in that species of the disease which arises from the application of narcotics.

Amaurosis may be confounded with cataract, but in the latter disease, whenever the diminution of vision is considerable, the opacity of the chrystalline lens is distinctly seen; whereas in amaurosis the humors are transparent, and this is the case even when the disease is complete. Although the state of the pupil is no mark by which we can judge of the existence of amaurosis, I believe the presence of the disease may be pretty accurately determined, by the inanimate appearance of the eye; by the patient being unable to direct the eyes towards any object, so as to place it in the axis of vision; by the rolling motion of the eye; and by the pupil being often' not quite circular. Conjoined with these marks, there is transparency of the humors; and the eye, if minutely examined, will frequently be found to exhibit at its bottom a dead white, or green appearance.

Amaurosis may be attributed to a variety of causes, all of which act in two ways, either directly upon the optic nerve and retina, inducing organic derangement, or sympathetically, so as to disturb the function. The disease sometimes comes slowly on, at other times is sudden in its attacks. It is often preceded by intense pain in the head, accompanied by flashes of fire from the eye, both of which symptoms subside when the disease is established. The pain is sometimes confined to one part, but, on other occasions, extends throughout the whole head. The patient generally complains of motes and insects floating before him, his sight is often considerably diminished long before he is aware of it, and he discovers it only by a sort of chance. The German writers enumerate a number of assignable causes for the disease, and some of them, particularly Beer, even attempt to point out the characterising marks of each species; but I am not aware that we can speak decisively on this point; and indeed in many cases, there is great difficulty in distinguishing betwixt an organic and a sympathetic amaurosis.

The most palpable causes of amaurosis are external injuries, pressure, over-excitement, a change of structure, suppressed secretions, derangements of the gastric system, the deleterious influence of narcotic substances, and congenital disease. When we reflect on these causes, and consider that amaurosis most frequently arises from the first four, we have strong reasons for pronouncing this affection to be in general incurable.

The first cause which we have assigned as producing amaurosis, is external injury, and this may operate in a variety of ways. Blows upon the head, from the disorganising effects of concussion, may give rise to it, or, by causing an immediate effusion of blood, may compress the optic nerve, so as to produce permanent blindness, although the patient may otherwise recover from the effects of the blow. Amaurosis has not unfrequently been produced by lesions of the supra-orbitary nerve; and wounds may either suddenly destroy the continuity of the optic nerve, or be followed by inflammation, which proves fatal to the structure. A remarkable instance of the former is related by Heister, where, in consequence of a musket ball traversing the forehead, the man became instantly blind; and although he recovered from the wound, the blindness continued.

The second cause, pressure on the optic nerve, or on the retina, is a very frequent origin of the disease, and may be either temporary or permanent. Temporary pressure is most frequently induced by an increased flow of blood to the head, as is exemplified in cases of difficult parturition, violent coughing, or excessive vomiting, all of which have occasionally produced amaurosis. Indeed, where there is a determination of blood to the head, even stooping to pick up any thing from the floor, or to tie the shoe, will so far derange the function as to produce blindness for a time; and we shall feel no difficulty in accounting for this phenomenon, when we reflect upon the connexion of the carotid arteries with the optic nerves. The nerves near their junction lie close to the arteries, so that they must be compressed by any increased impulse in these vessels. But the most intractable cause of amaurosis is permanent pressure, which has often been induced by hydrocephalus, by exostosis at the basis of the cranium, and by tumors in the brain in the course of the optic nerve, instances of which are recorded by Bonnetus, Platerus and others. The retina may be similarly compressed from the distension of the eyeball, as in hydrophthalmia, from a dilated state of the choroid vessels, or from serum effused under the choroid coat, a remarkable instance of which is taken notice of by Mr. Ware.*

The third cause of amaurosis enumerated is over-excitement in the organ; and this is by no means an uncommon origin of the disease. People have been struck blind by lightning, and blindness is often produced by the eye being long directed to minute objects, or by its intense application, especially during candle light. This is frequently the case with engravers and literary men. I knew one instance where the master of a printing office became blind. He had corrected the press, and was otherwise engaged in reading, for eighteen hours out of the twenty-four, a practice which he continued for twelve months, notwithstanding an evident failure of his sight. At the end of this time, the amaurosis was so complete that he could not distinguish one object from another, but was merely capable of perceiving the light, so as to find his way in the streets. He continued in this state for several years, but has now recovered his sight.

A fourth cause to which we considered amaurosis referable, was a change of structure in the optic nerve, or in its expansion. This change may on some occasions be imputable to inflammation; in other cases we are unable to account for it; but, on dissection, the nerve has been found shrunk and much diminished in size; and sometimes the retina has been firm and thickened.

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* See Ware's Chirurgical Observations on the Eye, vol. i. p. 510.

Suppressed secretions have been named as a cause of amaurosis; and these are much dwelt upon by the German writers, and the other humoral pathologists of the continent, as a frequent origin of this disease. I know of no instance where amaurosis could be fairly imputed to this cause, although such, particularly suppression of the menses and the hemorrhoidal flux, be admitted by the surgeons of this country. If the suppression of these discharges ever give rise to amaurosis, it must be by inducing general plethora, or causing an increased determination of blood to the head. Suppression of the menses is a common occurrence, even in plethoric women, while amaurosis does not seem to be more frequent in women labouring under obstructed catamenia than in others. I am therefore not disposed to view suppressed secretions as a frequent cause of the disease.

Derangements of the gastric system are frequently productive of amaurosis; in which case the disease is always a sympathetic affection; and this is the only species, which, comparatively speaking, is easily cured. It is difficult precisely to say what states of the alimentary canal give rise to amaurosis, but it has been observed that worms and accumulations of bile have often produced it.

Amaurosis may also be produced by the deleterious influence of narcotics. Narcotic vegetables, and some other poisons, which generally paralyse the nervous system, will act upon the optic nerve and retina, so as to induce blindness. This is particularly the case with the deadly nightshade, henbane, tobacco, and lead. A little boy who, deceived by their appearance, had eat several of the berries of the deadly nightshade, was in about an hour after attacked with a general affection of the nervous system, and among other symptoms he became quite blind with a dilated pupil. The blindness continued for two days, but I observed that it was upwards of a fortnight before the pupil was free from the influence of the narcotic, so as readily to contract and dilate, upon exposure to the various degrees of light.

The last cause of amaurosis which we enumerated as depending upon a direct affection of the immediate organ of vision was congenital disease. People have sometimes been born blind; and, upon examination, there has not been found either closure of the pupil, opacity of the cornea, or of the humors, I am unacquainted with any dissections of such cases; but the presumption is, that the imperfection in them is either in the retina or in the optic nerve, and perhaps one or other or both of these may be awanting. It is not probable that there is any malformation in the brain, because there is no deficiency of intellect, or other apparent want.

The causes which we have now enumerated, although not the sole, are the most frequent origin of amaurosis. It is a disease by no means rare, and is one of the most difficult to cure of any with which the eye is liable to be affected.

## TREATMENT OF AMAUROSIS.

When amaurosis occurs in the decline of life, when the disease comes slowly on, when it has been of long continuance, and when it is complete, but more especially when it is a congenital disease, or can be traced to an organic affection, it is always incurable. Again, when the amaurosis is not complete, and the patient is capable of perceiving the light, when the attack has been sudden, when the disease has been of short duration, and more especially when it is periodical, it is frequently cured. From the consideration of these circumstances, it becomes a primary object to endeavour to ascertain the origin of the disease; and although this cannot always be accomplished, yet on many occasions the surgeon may be greatly assisted in forming a judgment from accompanying symptoms. Thus, if the patient at the same time labour under hydrocephalus, if the amaurosis has been preceded by intense headach, and there is a co-existing state of palsy, there will be little reason to doubt that there is permanent pressure and an incurable disease; whereas, if there have been previous marks of a determination of blood to the head, such as headach, vertigo, and flushed countenance, attended with strong arterial action, it may be presumed that the function is only disturbed by temporary pressure; or, if there have previously existed irregularities in the gastric system, such as dyspepsia, or bilious attacks, we have then every reason to believe that the amaurosis is sympathetic, or dependant on morbid actions of the system, and therefore a manageable disease. Keeping these considerations in view, when the amaurosis is conceived to depend on increased vascular action, we employ general and topical bloodletting, blisters to the temples, behind the ears, and to the neck, and establish a continued discharge by means of savine or issue ointment. The head should be shaved, and the cold shower-bath used every morning; the bowels should not only be freely unloaded, but powerfully excited, by means of calomel combined with jalap, scammony, or gamboge; and the patient placed on a low diet. When the amaurosis proceeds from debility, in consequence of over excitement, as from a stroke of lightning, or long continued exertion of the eye, after clearing the alimentary canal by vomiting and purging, we have recourse to blisters repeatedly applied to the temple and forehead, to electricity, and to corroborants, such as bitters, and the preparations of iron. This is the species of the disease best adapted for electricity, but very frequently, neither electricity, blistering, nor any other means is able to effect a cure. When the amaurosis is thought to arise from irregularities of the stomach and intestines, we exhibit repeated emetics, the best of which is a solution of the tartrite of antimony, given in small doses at short intervals. We also purge, and after the alimentary canal has been well cleared, we employ bark, bitters and other corroborants to restore tone. These remedies must be long persevered in before we can expect any advantage from their use.

The Arnica montana, and Aconitum napellus, are much used in Germany; but in no cases of amaurosis have I ever seen them of any service.

In tropical countries, where the eye is much exposed to the action of the sun, the retina is apt to become so debilitated, that vision is materially impaired in the shade or in a feeble light; hence the inhabitants of those countries are frequently seized with amaurosis during the night. This disease has been termed Hemoralopia or night blindness. It is more apt to attack strangers than the natives, and seems to depend upon debility in the nerve, induced by previous excitement from exposure to a strong glare of light. The disease occurs very frequently among sailors and soldiers in the East and West Indies. It is, however, not entirely confined to these climates, as a similar state of the eye has been observed in persons who have been much exposed to reflected light from the snow. It would also appear, that, independently of long continued exposure to the sun's rays or the glare of the snow, much fatigue predisposes to this temporary amaurosis; and hence it has been observed to prevail more frequently amongst the common men than the officers; and the peasantry of the country are more frequently attacked than the higher orders.

The disease is slow in its approach; vision is perfect during the day, but about sunset is obscure; and as the night advances, the patient becomes so blind, that he cannot distinguish one object from another, except by bright moonlight or the light of a candle. He remains in this state during the night, but gradually recovers his sight as the sun rises in the morning. The sight continues perfect during the day, but again fails in the evening; and although, in the commencement of the disease, the patient was capable of discerning objects by moonlight, or the light of a candle, this ability in a short time ceases, and the amaurosis becomes complete, from the setting to the rising of the sun.*

This periodical amaurosis is sometimes cured spontaneously, more especially where the patient has been removed from the exciting cause. But as this cannot always be effected, or when it fails of success, recourse must be had to remedies. As the state of the retina in hemeralopia is similar to that which exists in amaurosis, produced by lightning, or by the long continued direction of the eye to minute objects, we adopt the same plan of treatment, and more successfully, because the disease is slighter in degree. This treatment, as we have already suggested, consists in electricity, and the repeated application of blisters to the temple and eyebrow, while the bowels are well cleared out by cathartics, after which the general tone should be restored by the preparations of iron, bitters, and other corroborants.

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* There are several writers on hemeralopia, but in none are the progress of the disease, its characterizing symptoms, and method of cure, so clearly laid down as in a paper by Mr. Bamfield, in the 5th volume of the Transactions of the Medico-Chirurgical Society of London.

## FUNGUS HEMATODES RETINAE.

In the first volume of this work, under the head of specific inflammation, I have described the great leading features of fungus hematodes, and pointed out the circumstances which distinguish it from cancer. In whatever structure it presents itself, in the eye, as well as in the other organs of the body, it is similar in its progress, and is characterized by the same symptoms. It is peculiar to early life, and excites no alarm in its commencement, as it is then attended with little pain, but it is always steady in its course, is never arrested by medicine, and its progress is particularly rapid after external injury. When it once proceeds to ulceration it immediately shoots out a fungus, which bleeds profusely upon the slightest accident, and when left to itself is uniformly fatal.

Fungus hematodes of the eye always commences in the retina or termination of the optic nerve. The disease is generally confined to one eye, and most frequently begins without any evident cause; but on some occasions has been traced to a blow, or at least no marks of the disease having been previously observed, we are led to connect it with the infliction of external injury. There is at first but little pain; the patient complains only of obscure vision, which, however, soon terminates in entire loss of sight; and, upon examination, the pupil is observed to be dilated and immoveable. The bottom of the eye exhibits an irregular surface, and is of a dark yellow, or sometimes greenish colour,—an appearance, not arising from any change in the vitreous humor, but evidently produced by a solid substance, which gradually occupies the place of the humors, and advances towards the cornea, filling up the coats of the eye. In proportion as the cavity fills up, the eye loses its globular form, becomes irregular in its shape, and knobby. From pressure, the venous circulation is obstructed, and hence the sclerotic coat acquires a dark blue or purple colour. From the distension of the coats of the eye by the tumor there is now great pain; when it has filled up the whole cavity, it presses upon the cornea and makes it protrude; and, by the continued pressure, the cornea either bursts or ulcerates. The disease now advances with considerable rapidity, for the tumor, being no longer circumscribed, sends out a fungus, which soon attains to great size, discharges copiously a thin fetid matter, and often bleeds profusely. When the fungus grows large it appears to be unable to maintain its vitality, and the external parts of it fall into gangrene and drop off in pieces, but the fungus is soon reproduced. Sometimes the tumor, instead of making its way through the cornea, bursts the sclerotica, then rises in the socket by the side of the eye, and causes protrusion of the organ. In this state it is covered by the conjunctiva, and conveys so much the sensation of fluctuation when pressed on, that the surgeon here, as in other parts of the body, is apt to puncture it with a lancet, believing it to contain matter. When the disease has been of some continuance, and more especially after the eye ulcerates, the lymphatic glands about the cheek, the angle of the jaw, and upper part of the neck, swell, and sometimes inflame and ulcerate; at other times they merely attain an immense size, and, upon examination, are found to be precisely of the same structure with the diseased eye.

This is the short history of a disease, which is well described by many writers on surgery, but which, till lately, was always confounded with cancer. Both Chesselden and Desault have remarked, that cancer of the eye occurs more frequently in infancy than in adult years; but there is every reason to believe that the cases they have alluded to were those of fungus hematodes, and not of cancer. The former, as we have observed, is a disease of early life, while cancer appears most commonly in advanced life. In twenty-four cases of fungus hematodes which came to the knowledge of Mr. Wardrope, twenty of them were under twelve years of age.[*]

## TREATMENT OF FUNGUS HEMATODES RETINAE.

The dissection of the diseased structure shows that in fungus hematodes of the eye, the retina or optic nerve has always undergone a remarkable change; and where the disease has been of some continuance, this is even observed in the brain, particularly in that part from which the optic nerves arise. This changed state of the nerve and early affection of the brain are unfavourable to the success of extirpation, and accordingly the disease has generally returned after an operation; but as no medicine or mode of treatment has hitherto been discovered which has any influence over the disease, we are naturally led to have recourse to extirpation. The operation should always be performed at an early period, otherwise so far from arresting the progress of the disease, it both adds considerably to the suffering of the patient, and hastens his death. When the disease returns, it is generally very early after extirpation. At the bottom of the orbit a fungus is first observed, which in a short time so fills the cavity, as to make the eyelids protrude, and is of the same nature with that which projected through the cornea before the operation. It discharges a very fetid matter, often bleeds profusely, and cannot be repressed either by caustics or the actual cautery.*

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[*] See Wardrope on Fungus Hematodes, p. 25.

## CANCER OF THE EYE.

THAT affection which has been arranged under the name of cancer of the eye, presents such a variety of appearances that it is difficult to be described. When it occurs it is generally after the meridian of life, and one eye only is commonly affected. Sometimes it commences in the eyeball, and after a longer or shorter time the eyelids become involved; at other times a tumor is first observed above the caruncula lachrymalis, or a malignant ulcer appears on one of the eyelids; the eyeball then becomes hard and knobby, and begins to protrude from the socket. It would appear that this affection does not, like fungus hematodes, commence in the deep-seated parts of the eye, but first takes place in the skin or in its continuation, the mucous membrane covering the sclerotica and cornea.

Cancer of the eye sometimes takes place after long continued ophthalmia, especially in the decline of life; at other times it can be traced to a blow, and often the disease appears without any apparent cause. The patient first complains of heat and itching in the eye, attended by an increased flow of tears, soon after which the eyeball is observed to grow hard, irregular, and knobby; the blood-vessels on its surface enlarge and become varicose, when it begins to protrude from the socket, and acquire a dark blue colour. The disease is now attended with a burning pain in the eye and severe shooting through the head. In proportion as the eye protrudes from the socket, it raises and separates the conjunctiva from the eyelids, and this membrane appears in the form of two bands, one at the upper and one at the lower part of the tumor bracing it down. When the eye has attained some magnitude, the disorganization is complete, the sight is entirely gone, and the tumor feels firm like a piece of flesh. It sometimes ulcerates and discharges a fetid matter, and from its pressure always destroys the bones of the orbit. When ulceration takes place, the ulcers have hard, irregular, and everted edges, not unfrequently discharging large quantities of blood from the dilated vessels. The lymphatic glands in the neck at last swell and become painful, and the constitutional irritation, combined with the local suffering, destroys the patient.

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* For a representation of fungus hematodes retinae, see Fig. 1. Plate XIV. The drawing was taken from an eye, which I lately extirpated in the case of a child of two years of age, and is quite characteristic of the disease.

## TREATMENT OF CANCER OF THE EYE.

Extirpation is the only cure for cancer, and we operate in it with greater confidence of success than when the eye is attacked with fungus hematodes; however, unless the operation is performed early, it will not only be of no avail, but increase the misery, and even tend to hasten the patient's death. In the latter stage of cancer of the eye, the tumor adheres to the orbit, the bones become carious, and the brain is at last diseased. In these circumstances, we can have recourse only to palliative measures, which consist in anodyne fomentations and cataplasms, the occasional application of caustics, and the internal exhibition of narcotics.

## EXTIRPATION OF THE EYE.

Extirpation of the eye may be had recourse to for the removal of a malignant disease, or for deformity arising from an unseemly tumor; but the operation is most commonly resorted to on account of fungus hematodes, and cancer. It is simple in itself, easily performed; and the sooner it is done, the greater the chance of success. If the eyelids are diseased, they should always be removed along with the eye; but if this is not the case, their preservation is of great consequence, as they cover the orbit after the removal of the eye, and lessen the deformity. In performing this operation, the patient may be laid on his back, or seated in a chair, either of which postures is equally convenient for the operator. Whether the tumor be large or small, the surgeon will find that he has a greater command over it in the extirpation, by passing a ligature through its substance. Therefore, after the patient has been properly placed, the first step of the operation should be, to pass, by means of a crooked needle, a broad ligature through the lower part of the cornea. By carrying the needle pretty deep into the substance of the eye, and bringing it out at the upper part of the cornea, he will acquire a firm hold. The ligature should then be knotted, and during the operation the surgeon may retain it in his left hand, or occasionally commit it to his assistant. If the eye is so much enlarged, as to be closely braced down by the eyelids, the surgeon should always make a free incision at the external angle, in the direction of the commissure of the eyelids. This enables him more easily to expose the eye, and greatly facilitates its removal. The eyelids are to be separated by the forefinger and thumb of the operator's left hand, or by the aid of his assistant, and the knife carried round in the course of the orbit through the conjunctiva, so as to separate the globe from the eyelids. After this separation has been effected, the eyeball is to be dissected out by carrying the knife in the track of the cellu-

# CHAPTER XV.

## DISEASES OF THE EAR.

### GENERAL REMARKS ON THE STRUCTURE OF THE EAR.

ANATOMISTS, in their description of the ear, have arranged it in three divisions: External, Middle, and Internal. This simple arrangement is the most suitable in the consideration both of its structure and its diseases.

1*st*, THE EXTERNAL EAR.—The external ear is nearly wholly composed of cartilage. It consists of an irregular cavity for collecting sounds and of a tube for conveying them to the tympanum or middle ear. The cartilage is attached to the cranium by ligaments, is moveable by muscles, and when cut, can be reunited like any muscular part. The tubular part, with a portion of the temporal bone, forms the meatus auditorius externus, is about an inch in length, lined by the common skin covered with a very thin cuticle, and beset by a number of small glands, which secrete the ear-wax.

2*d*, THE MIDDLE EAR.—At the end of the meatus auditorius is placed the tympanic cavity or middle ear, situated partly in the squamous, and partly in the petrous portion of the temporal bone. It is separated from the external passage by a membranous septum, called membrana tympani, or drum of the ear. This membrane is tense in the dry preparation, but of a funnel shape in the recent subject, and is very vascular, particularly in early life. The tympanum contains the ossicula, or little bones, and the muscles which move them. The bones are four in number: the malleus, the incus, the lenticulare, and the stapes. All these bones are connected together, and are moved by muscles. They are also attached to the membrana tympani, and to a membrane which shuts up the fenestra ovalis, a small oval hole leading to the labyrinth, or internal ear, and forming a chain of connexion, the chief use of which is to increase the strength of the vibration of the air, and convey it to the seat of the sense. The handle of the malleus is attached to the inside of the centre of the membrana tympani; its round head is received into a depression in the body of the incus; and from its neck proceed two processes, into the longer of which the tendon of the laxator tympani is inserted. The os lenticulare projects from the long branch of the incus as a sort of process, and is connected to the head of the stapes; the base of which rests upon the fenestra ovalis. These bones are frequently discharged by the tympanic cavity suppurating, an occurrence which frequently takes place in scarlatina; but in which, provided the stapes keeps its place, it is very singular the hearing is only deteriorated, not entirely destroyed. But when the stapes is removed, the fluid of the internal ear, or the aqua labyrinthi escapes, and this is followed by incurable deafness.

The tympanic muscles, which are four in number, are inserted either into the malleus or stapes, but not into the incus or lenticulare. They all seem to act upon the membrana tympani, which they either relax or make tense.

The tympanum is lined with a vascular membrane, which, like the mucous membrane of the nostrils, secretes a fluid that keeps it moist. This cavity has an open communication with the mouth, and with a chain of cells in the mastoid process of the temporal bone. It is separated from the external ear by the membrana tympani, and at its posterior part there are two small holes closed up by membranes which lead to the internal ear. Upon the upper one, called the fenestra ovalis, which leads to the vestibule, the basis of the stapes rests. The lower and smaller one is the fenestra rotunda, leading to the inner part of the cochlea.

The first open communication of the tympanum is with the mouth, by means of the Eustachian tube. This tube is of a funnel or trumpet shape, large towards the mouth, and small towards the ear. It opens immediately behind the posterior nares, is about an inch and a half in length, and terminates in the tympanum at its lower and anterior part. At its commencement it is so large as nearly to receive the point of the little finger, and its mouth is so situated, that, in the act of swallowing, it is covered by the velum pendulum palati, which prevents the food entering the tube. It runs in an oblique direction towards the ear, is partly membranous, partly cartilaginous, and partly bony,—membranous towards the mouth, cartilaginous in the centre, and bony towards the tympanum. The use of the Eustachian tube is to allow the air to pass freely into the tympanum, by which the free vibration of the membrana tympani is maintained. It is lined by a continuation of the Schneiderian or common mucous membrane; and, although its sides do not adhere, it is subject when inflamed to stricture. It is also liable to congenital imperforation, to closure of its mouth in consequence of cicatrices from ulceration of the fauces, and to obstruction from thickened mucus, all of which prove a cause of deafness.

The second open communication of the tympanum is with the mastoid cells. There is one large opening and several small ones, by which the communication is so very free, that when these cells suppurate, the matter passes readily into the tympanum. They are lined with the same membrane as the tympanum, and their use is to render the impression of the sense more distinct, by reverberating the sound; and hence, in those animals where the cells are numerous and large, the hearing is very acute.

*3d*, THE LABYRINTH.—The internal ear, called the Labyrinth, is situated beyond or internal to the tympanum, and consists of three parts, the vestibule, the cochlea, and the semicircular canals.

The vestibule is the central cavity of the labyrinth, is of a spheroid form, and in it we discover no less than eight openings,—the fenestra ovalis communicating with the tympanum, one opening leading to the cochlea, another, called the aqueductus vestibuli, running from below upwards, and terminating in the cranium, on the fore part of the pars petrosa, and five openings leading to the semicircular canals.

The cochlea is so called from its resemblance to a snail. Its apex is placed more anteriorly than its basis, close by the side of the Eustachian tube. In it are two canals, separated by a spiral septum, which run into each other at the apex; but at the other end or base, one canal opens into the tympanum by the fenestra rotunda, and the other turns into the vestibule. That which opens into the tympanum by the fenestra rotunda, is shut or closed up by a membrane, but that which runs into the vestibule is open and free.

The semicircular canals are three in number; 1st, The superior, situated in the upper part of the pars petrosa, with its convexity upwards.—2d, The exterior, the least of the three, placed horizontally next the tympanum, with its convexity backwards; and 3d, The posterior, situated obliquely and farther back than the superior, with its convexity backwards. The orifices of all these canals communicate with the vestibule, because they both arise from it and end in it; but they are only five in number, as two of them terminate in one common opening.

The labyrinth, consisting of the vestibule, cochlea, and semicircular canals, is lined with a fine periosteum, which closes up the two fenestrae; and it contains membranous sacs and tubes filled with fluid, upon which the portio mollis of the seventh pair of nerves is expanded. In consequence of the internal ear containing fluid instead of air, the vibration is rendered stronger, and a more distinct impression conveyed to the nerve.

## DISEASES OF THE EAR.

The diseases of the ear are few in number, and the pathology is also obscure. The external and middle ear are the only parts of the organ in which disease can be remedied by an operation, and they may be deranged to a considerable extent without producing total deafness. The entire loss of hearing always depends upon disease in the internal ear, or in that part of the brain, from which the auditory nerve arises. Even a congenital disease, when confined to the external or middle ear, may be cured, but when situated in the internal ear, is not curable either by medicine or surgery.

I shall arrange the few observations which I have to offer, on the pathology of the ear, under the diseases of the external, the middle, and the internal ear.

## SECTION I.

### DISEASES OF THE EXTERNAL EAR.

The diseases of the external ear, with the exception of a malconformation to which it is subject, are in general easily cured. They consist chiefly of a native imperforation, polypus, herpetic ulcerations, and hardened wax obstructing the passage.

### NATIVE IMPERFORATION OF THE EAR.

Children are occasionally born with one or other of the natural passages imperforated, and this is sometimes the case with the ear. When this does happen, the malformation is followed only by imperfect hearing, and not by total deafness, if the Eustachian tube is open. Sometimes the external opening is merely covered by a thin skin, and sometimes the tube is entirely closed; whilst at other times the tube, although not closed, is so much contracted as to have a marked influence on the hearing. The defect may be confined to one ear, or both ears may be involved.

When the passage is covered only by a thin skin, or when the imperforation does not extend to any depth, it may be cured by making a crucial incision with the point of a bistory, and inserting a piece of sponge tent to dilate the passage. When the whole passage is filled up by a solid substance, we are desired to perforate with a trocar, or to cut down towards the tympanum in the natural direction of the passage. This may be attempted, but in these circumstances the case may be considered hopeless. The passage, when merely contracted, may be gradually dilated by sponge tent. If one ear is perfect, I conceive, that, although the passage to the other be obliterated by solid matter, no attempt should be made to remedy the defect by operation.

## POLYPUS OF THE EAR.

The meatus auditorius externus is sometimes filled up by polypi, or fungous excrescences. They arise either from the sides of the tube, or from the membrana tympani, and always cause imperfect hearing. The excrescence is sometimes firm, moveable, and has a slender base; but most commonly it is soft and loose with a broad base, and then is always attended with a profuse discharge of purulent matter. In these circumstances, the discharge not unfrequently proceeds from a suppuration of the tympanum; and when this is the case, the membrana tympani is destroyed.

When the polypus is firm, and has a slender base, the surgeon should attempt to remove it by ligature; but when the excrescence is soft, and the base broad, he may remove as much of it as he can by forceps, and destroy the remainder by caustic. During this process the ear should be frequently washed with tepid water, or with luke-warm milk and water, while some slightly astringent solution is occasionally injected, such as of the sulphate of alum, of the sulphate of zinc, or of the acetate of lead.

## HERPETIC ULCERATIONS OF THE EAR.

In consequence of some specific inflammation, it frequently happens that the cartilage and tube of the ear become covered with small ulcerations, like those situated on the scalp in tinea. These ulcerations are sometimes attended with a great degree of inflammation and swelling, by which the tube of the ear becomes so much contracted as greatly to affect the hearing. Deafness is also produced by the discharge from the ulceration becoming thickened, and obstructing the passage. The inflammation sometimes extends to the figured part of the ear, and is attended with a burning heat. When it prevails to this extent, there is always a copious fetid discharge. I have seen this disease most frequently in children in the lower ranks of life.

In the treatment of herpetic ulcerations of the ear, the best practice is to wash out the tube every night at bed-time with warm milk and water, thrown gently in by a syringe, then to anoint the sores by means of a hair-pencil, with a little of the Ungt. Oxid. Hydr. Nitrat., or the Ungt. Oxid. Hydr. Rubr., washing it off every morning with warm water and soap, and dusting the parts during the day with the impure oxide of zinc, the impure carbonate of zinc, or with ceruse. But if there is much inflammation, it will be necessary at the same time frequently to foment with warm solutions of opium, or of the acetate of lead, and occasionally to apply a saturnine poultice. If the disease is thought to be connected with a constitutional affection, the patient, independent of the local treatment, should be put on a course of the compound calomel pill, and the decoction of sarsaparilla, with the occasional use of the warm bath.

## HARDENED WAX IN THE EAR.

THE most common cause of deafness referable to the external ear, is hardened wax closing up the meatus auditorius externus. The thinner part of the wax evaporates, and the thicker part becomes hard, and remains in the passage. This species of deafness is always accompanied by a noise in the ear. It is more easily cured than any other kind of deafness, and the means of cure are most simple. The existence of wax may be easily detected, by pulling up the cartilage and looking into the ear, when exposed to the sun.

When the deafness is found to arise from hardened wax, warm water with soap is the best menstruum. The ear should be repeatedly syringed with it, when we shall commonly find the wax floating out in small pieces. Sometimes it comes out in a large piece, after which the hearing is immediately restored. Any foreign body sticking in the passage will be as effectual in impairing the hearing as hardened wax. Several years ago I was applied to by a country-man, who had been very deaf for twelve months: finding, upon examination, both ears filled with a black matter, which I took to be wax, I freely syringed them, but very little was discharged, and upon looking into the tube, I still perceived the same black substance close upon the membrana tympani. Accordingly, making use of a pair of small forceps, I extracted from each ear a large piece of cotton covered with wax, when his hearing was instantly restored. He now recollected having stuffed his ears with cotton twelve months before this period.

Hearing, as far as it depends upon the external ear, may be more or less impaired, according to the states of secretion in the tube. Sometimes the secretion is diminished, or entirely suppressed, and, at other times, it is preternaturally increased. Both of these states are productive of partial deafness, particularly the former. When the secretion is suppressed, the defect is best remedied by the occasional introduction of a few drops of the oil of almonds, or of olive oil. When there is increased secretion, it must be obviated by the injection of the solution of alum, of kino, or of the sulphate of zinc, or some other astringent.

## SECTION II.

### DISEASES OF THE TYMPANUM OR MIDDLE EAR.

The diseases of the tympanum are more difficult to manage, and are more certainly productive of deafness, than those of the external ear. Yet the tympanic cavity may be deranged to a considerable extent without producing total deafness. The most common affections of this part of the organ are closure of the Eustachian tube, and inflammation and suppuration of the tympanum and mastoid cells.

## CLOSURE OF THE EUSTACHIAN TUBE.

THE Eustachian tube may be permanently shut from a congenital affection. It may be choked up with thickened mucus from inflammation of the lining membrane, produced by a common cold; or it may be closed from the cicatrices of ulcers in the throat, induced by cynanche maligna, or syphilis; from enlarged tonsils, from nasal polypi descending into the throat, and even from the general swelling in the common inflammatory sore throat. From whatever cause the closure of the tube proceeds, it always produces a degree of deafness proportioned to the obstruction. In the native imperforation the deafness is complete, and, in consequence, the subject of it is dumb.

When a patient presents himself with deafness, the first object of the surgeon is to endeavour to ascertain in what part of the organ the affection is situated. If the disease resides in the internal ear, the patient will be unable to perceive the beating of a watch, although it be applied to the side of the head, or placed betwixt the teeth; but if he hears the watch when placed in this situation, the surgeon may conclude, that there is no affection of the nerve, and that the deafness is not referable to this part of the organ. He should next examine the external ear, and if he perceives nothing wrong in its conformation, or any obstruction in the tube, he naturally suspects the cause to reside in the middle ear, and if there has been no discharge nor previous inflammatory affection, there is every reason to believe the deafness arises from obstruction in the Eustachian tube. When the obstruction of the tube is a congenital disease, there is generally a malconformation of the fauces, and when it is closed from tumors or the cicatrices of ulcers in the throat, the deafness will be found to have been preceded by some disease in that part. To ascertain if the Eustachian tube is obstructed, we desire the patient to grasp his nostrils, and then to attempt to blow forcibly through the nose. If the tube is open, the air will be felt passing along into the ear, and forcing the membrana tympani outwards; but if it be obstructed, no peculiar sensation will be felt in the ear.

When the deafness is traced to obstruction in the Eustachian tube, it is desirable to ascertain whether the obstruction be permanent, or arises merely from thickened mucus, because, in the former case, it will be necessary to make an opening in the membrana tympani to admit the air into the tympanum, whereas, in the latter, the tube may be cleared by injection. When the obstruction is congenital, or is preceded by ulceration in the throat, the tube will be permanently closed; but when it arises from a common cold, the presumption is, that the tube is merely obstructed from mucus.

The puncture of the membrana tympani for the cure of deafness, arising from closure of the Eustachian tube, was first proposed and practised by Sir A. Cooper. Several cases are detailed by him in the Philosophical Transactions for 1801, where the operation instantly restored the hearing. The operation has now been many times performed, but with various success. Sometimes it has perfectly succeeded, but on other occasions has failed, from the artificial opening again closing. The membrana tympani is very vascular, particularly in a child, and if the puncture is not sufficiently large, the activity of the vessel will soon close it up; while again, if an extensive opening is made, the tension of the membrane will be so much destroyed, that little or no advantage can be derived from the perforation. In performing this operation, the two chief circumstances to which it is necessary to attend, are the size of the instrument, and the place of perforation. Some surgeons puncture with a large couching needle, but in using this instrument, there is some danger of injuring the opposite side of the tympanum. A trocar with canula is therefore preferable, and the instrument should be so constructed that its point should not pass more than the eighth of an inch beyond the canula. To render the opening sufficiently large, and to lessen the chance of its closing, the trocar should be at least of the size of a common probe. With regard to the place of perforation, the puncture, from the situation of the handle of the malleus, should be made at the lower part of the membrane, either anteriorly or posteriorly, in either of which situations there is a vacant space sufficiently large for a safe puncture. Sir *A.* Cooper directs it to be made at the inferior and anterior part. If the cartilage of the ear be pulled upwards, and the tube exposed to the sun, the membrane can be distinctly seen, and the attachment of the malleus will be quite perceptible. The puncture of the membrana tympani is a very simple operation. The patient should be placed in a clear light, an assistant should pull up the cartilage so as to expose the membrane, and the surgeon then placing the canula upon the part to be perforated, pushes the retracted trocar through it.

We have recourse to the operation of puncturing the membrana tympani for permanent obstruction of the Eustachian tube; but the tube is sometimes obstructed by thickened mucus, causing partial deafness. It has, in such cases, been proposed by Mr. Wathen to wash away the mucus, by injecting warm water from the posterior nares. The practice has been attended with success, and may be effected in the following manner: A silver tube, about the thickness and length of a common probe, somewhat curved at the end, and fitted to the syringe for injecting the punctum lachrymale, is to be introduced into the nostril, with its convexity upwards, and carried backwards and a little downwards, till it arrives at the posterior part of the nostril; the convexity is then to be turned towards the septum, when the extremity of the instrument will easily pass into the Eustachian tube; and by means of the syringe, warm water is now to be repeatedly injected, till the obstructing mucus be completely washed out. To enable the young surgeon to inject the Eustachian tube with facility and effect, he should accustom himself to pass the probe in the dead body.

## INFLAMMATION AND SUPPURATION OF THE TYMPANUM.

THE tympanic cavity is very subject to inflammation, which frequently terminates in suppuration, and is followed by deafness, proportionate to the destruction of structure. The disease is most frequently induced by the inflammation in catarrh, or in cynanche tonsillaris extending along the lining membrane of the Eustachian tube to the ear. It therefore most frequently originates in a common cold; and if the inflammation is slight, and proper antiphlogistic remedies have been resorted to early, is not attended with much danger; but if the inflammation is violent, and more especially if no means have been employed to subdue it, the tympanum suppurates, the membrana tympani ulcerates or sloughs, and the bones of the ear are discharged,—an event always followed by deafness.

The inflammation, which terminates in destruction of the membrane of the tympanum, and the discharge of the ossicula, is more frequently attributable to scarlatina than to any other cause; and when there is much affection in the throat in this disease, it is very apt to be followed by suppuration of the tympanum, and consequently deafness.

In inflammation of the tympanum, there is an intense throbbing pain in the ear, occasionally shooting through the whole side of the head, and returning in paroxysms like the toothach. It is generally attended with acute pain, and not unfrequently delirium. From the continuity of the lining membrane, the inflammation sometimes extends to the mastoid cells, and is then productive of great distress. On some occasions it has extended to the brain, and terminated in death, but this is a rare occurrence. It more frequently ends in suppuration, and when the inflammation has not been violent, and the suppuration limited, the discharge gradually ceases, and the hearing is not materially injured; but those who have once had an inflammation of the tympanum are subject to renewed attacks of it upon catching cold, and thus the hearing is at last materially injured.

Inflammation and suppuration of the tympanum are always accompanied with deafness to a greater or less extent. In the inflammatory stage, the deafness is produced by the general thickening of the membranes; but the hearing is restored in proportion as this abates. In the suppurative stage, the deafness arises from the destruction of structure; and if this prevails to a great extent, the hearing, when the discharge stops, is restored only in a very slight degree. When the tympanum inflames and suppurates in a common cold, the ossicula are not often discharged; but when this cavity inflames in scarlatina, from the violence of the action the membrana tympani extensively ulcerates or sloughs, and the little bones come away. Yet although the membrane be completely destroyed, and a considerable portion of the bones be discharged, the hearing is not altogether lost. If the stapes maintains its situation, so as to close up the fenestra ovalis, and prevent the escape of the fluid from the labyrinth, deafness is produced only to a certain extent. In suppuration of the tympanum, the discharge is most commonly ichorous, sometimes tinged with blood, and not unfrequently has a very fetid smell. It is apt to be increased upon the slightest accession of cold, when the parts become inflamed and there is great pain. In this diseased state of the ear, the meatus is frequently filled with fungous excrescences, which contribute greatly to the deafness.

In purulent discharges from the ear, we judge that the flow of matter is from the tympanum and that the drum is more or less destroyed, by the escape of the air from the meatus externus when the patient forcibly blows his nose. If the Eustachian tube is open, the air will be seen bubbling through the discharge; and when a lighted candle is presented, the flame will be visibly agitated. The state of the membrane may be also ascertained, by exposure to the rays of the sun, and by the introduction of a probe. If there is an opening in the membrane, the instrument will be felt striking the bone.

In the inflammatory stage of the disease, the most active measures should be had recourse to, in order to prevent the inflammation terminating in suppuration; and if it has originated in a common cold, and the action is not very violent, the surgeon will frequently be successful. Local blood-letting should be immediately employed, which is best effected by placing a number of leeches over the mastoid process; a blister should then be applied behind the ear; warm opiate and saturnine fomentations should be used for half an hour at a time, and repeated three or four times in the course of the day; while in the intervals, the steam of hot water is conveyed into the meatus externus. When the throat is affected, or when the Schneiderian membrane lining the nostrils and frontal sinuses is inflamed, the exposure of the whole head to steam produces a general secretion from this extensive mucous surface, and has frequently a very marked effect in removing inflammation of the ear. Independently of these remedies, the patient should be repeatedly purged, and a general antiphlogistic treatment rigidly adhered to.

If the inflammation terminates in suppuration and ulceration of the membrana tympani, or if a puriform discharge has been established before the surgeon is called, the proper remedies are astringent injections to stop the discharge; and if the little bones of the ear are not evacuated, when the flow of matter ceases the hearing is frequently greatly restored. The state of the hearing, however, depends upon the injury done to the structure; for it often happens when the bones come away, that, although the discharge may be stopped, the hearing is not restored; and in some cases, it is even worse than while the discharge existed. But whether the surgeon 'should be successful or not in removing or lessening the deafness, it should be his aim to stop the discharge, as it is always offensive; and, if there are no carious bones, he will generally succeed. Injections that are slightly astringent should be used in the first instance, such as rose water, infusions of green tea, or weak solutions of alum; and after these have been continued for some time, the solutions of some of the metallic salts should be employed, the best of which are those of the super-acetate of lead, or the sulphate of zinc, in the proportions of two grains of the salt to one ounce of water, and gradually increased in strength as the parts can bear it. These solutions may be thrown in by means of a syringe; but, if this excite pain, the patient may be laid down upon his side, and they may be dropped into the ear by means of a piece of sponge. The injections should be used four times a day; and, during their continuance, the ear and side of the head should be well bathed with cold water evening and morning. This mode of treatment will sometimes be rendered more successful, by applying occasionally, behind the ear, a small blister.

Any fungous excrescences in the meatus should be removed by tearing and pinching them with forceps, and afterwards destroying the roots by means of the argentum nitratum.

## SECTION III.

### DISEASES OF THE LABYRINTH OR INTERNAL EAR.

The internal ear is the only part of the organ which is essential to hearing, while the external and middle ears are merely auxiliary; and when deafness is a congenital disease, it generally arises from an affection of the labyrinth, such as malformation or insensibility of the nerve. When the depot is situated in this part of the structure, it occasions the worst and most hopeless species of deafness. In such cases the patient is always dumb; and when a watch is applied to the side of the head, or placed betwixt the teeth, he is incapable of hearing it.

### MALFORMATION OF THE INTERNAL EAR.

THE most important organs of the body are occasionally so changed from their natural conformation, as to be unfitted to perform their functions; and this is sometimes the case with the internal ear. The labyrinth is beyond the reach of examination, so that when its organization is in fault, it is impossible to say what the nature of the malformation is. The internal ear has been found filled with a solid substance instead of fluid, as in a case dissected by Mr. Cline, where the labyrinth contained a caseous matter; and in the deafness of old age, it has been observed that the fluid has escaped, and the cavities been found empty. When deafness depends upon malformation of the internal ear, the disease is complete and incurable.

### NERVOUS DEAFNESS.

WHEN the auditory nerve has lost its sensibility, a disease is induced similar to amaurosis, and probably depending on the same causes. Indeed the affections of the auditory and optic nerves are so analogous, that derangement of the gastric system has produced deafness as well as amaurosis. If the deafness originates in a change of structure, it is incurable; but if it arises from disordered function, like those species of amaurosis which depend upon this cause, it may be cured, and the same reasonings and remedies are applicable to both diseases. Nervous deafness is always attended with a buzzing or hissing noise in the ear. If the sensibility of the nerve is quite gone, the patient is incapable of hearing the ticking of a watch when held to the side of the head; and when the disease is congenital, it may be accounted incurable. If the organization of the brain is in fault, or if a tumor presses on the course of the nerve, the deafness is irremediable; but if it arises from fulness in the vessels, or from debility, it may be cured.

If the deafness is accompanied by headach, and seems to depend upon increased vascular action, free depletion, both general and local, should be had recourse to. Blood should be taken from the arm or the temporal artery, and leeches should occasionally be applied over the mastoid process. Blisters behind the ear will also be of service, and more especially an issue in the neck. The head should be shaved, and either cold ablution or the shower-bath used every morning; while the bowels are unloaded by purgatives, and the patient placed on a low diet. If the atony in the nerve has arisen from over-excitement, as from long exposure to the noise of cannon, or from fever, or the debility of old age, stimulants should be tried, the best of which are laudanum, ether, the camphorated spirit of wine, or the juice of garlic dropped into the ear, or introduced by means of a little cotton. Blisters may be at the same time used with advantage; and if all these fail, electricity or galvanism should be tried.

In those cases where there is partial deafness, or where the patient labours under what is called hardness of hearing, which cannot be remedied by medicine, whether the defect depends upon lesion of the tympanum, or debility in the nerve, acoustic instruments, as the hearing trumpet, are our only resource.

# CHAPTER XVI.

## DISEASES OF THE NOSE AND ANTRUM MAXILLARE.

### GENERAL REMARKS ON THE STRUCTURE OF THE NOSE AND ANTRUM.

The cavity of the nose is divided by a septum, which is composed partly of bone and partly of cartilage. The upper and back part of the septum is formed by the os ethmoides and vomer, and the lower and fore part is cartilaginous, and connected with the other cartilages of the nose. One nostril is frequently larger than the other, from the vomer inclining more to one side. The nostril communicates at its upper part with the ethmoidal, sphenoidal, and frontal sinuses, laterally with the antrum maxillare, and posteriorly with the fauces. The upper and lateral part is separated from the orbit by the os unguis, and the floor leading backwards to the fauces is composed of the palatine plates of the superior maxillary and palate bones, which separate it from the mouth. The superior spongy bones are situated in its upper and middle part, and the lower spongy bone is placed low on the side of the antrum. The spongy bones are of a convoluted form, with their convex surfaces towards the septum; and the two upper are parts of the ethmoid bone, but the lower is a distinct bone. All these bones are attached to the sides of the nose by their upper margin, but their lower edge hangs free. Betwixt the superior and middle bones, the ethmoidal and sphenoidal sinuses open into the nose; betwixt the middle and lower bones, the frontal and maxillary sinuses communicate with the nasal cavity; and under the inferior edge of the lower one opens the nasal duct.

The antrum, or maxillary sinus, is a large cavity situated in the superior maxillary bone, and communicating with the nose by an opening immediately above the lower spongy bone. This opening is of the size of a large crow-quill, and easily permits any increased secretion or other fluid to pass into the nostril, when the patient is lying on the opposite side. The walls of the antrum are thin, its roof is the floor of the orbit, its lower part is formed by the alveolar processes, and the palatine plate sof the maxillary bone; and the cavity itself is situated over the four first molares, so that the fangs of some of these teeth not unfrequently perforate it.

The cavity of the nose and the sinuses are lined by one common membrane, which is of great extent, and not only lines the nostrils and all the communicating cavities, but even passes down the œsophagus and trachea into the intestines and cells of the lungs. Its extent may be judged of by its inflammation in catarrh, for exposure to cold produces cough, soreness in the breast, sore throat, a discharge of mucus from the nose, weight in the frontal sinuses, and pain in the ears. This membrane has a profusion of vessels, but is more thick and vascular in some parts than in others. It is thicker on the convex surfaces of the spongy bones, and at the edges of their convexity the membrane is so loose as to form a sort of border or fringe; it is less thick where it covers the septum, and thinner and less vascular in the antrum and other sinuses.

The bones within the nose which form the partitions betwixt the sinuses and other cavities, are not of a cancellated structure. They consist of only one thin plate, and, therefore, when the membrane is stript off, or its vascularity destroyed by pressure, having no internal source of circulation, they immediately die, and are not regenerated.

## SECTION I.

### DISEASES OF THE NOSE.

The diseases of the nose are few in number, but by no means unimportant. The principal ones are ozæna, polypus, and hemorrhage.

### OZÆNA.

Ozæna is a malignant ulcer situated within the nostrils. The disease commences like catarrh, with a slight redness and swelling of the schneiderian membrane, which sometimes extend to the skin and cartilages of the nose. This redness and tumefaction are accompanied with an increased discharge of mucus, and a difficulty of breathing through the nostril; but there is little pain, except when the nose is pressed upon, or when the finger is introduced, and this is sometimes followed by a slight discharge of blood. The ulceration is not long confined to the mucous membrane, but soon extends to the cartilages and bones; and it not unfrequently happens, that, before a surgeon is applied to, it has passed through the cartilage, and formed a communication betwixt the nostrils. This malignant ulcer spreads with more or less rapidity in proportion to the inflammation, and the bones soon become carious. In the progress of the disease, the sense of smell becomes impaired, and when the structure is extensively destroyed, it is entirely lost. In the early stage, the discharge is thin and ichorous, and when the bones are affected, extremely fetid. The vomer and ethmoides are the bones which are generally carious, but not unfrequently the lower spongy bones are destroyed, and the caries in some cases extends to all the bones within the nose, and even to the palatine plates of the superior maxillary bone. When the cartilaginous part of the septum is gone, the lower part of the nose falls flat, producing great deformity. The flattened form of the nose is frequently increased by the pressure of the bandage employed either to retain the dressings or to conceal the disease.

Ozæna has been ascribed to cold, blows, or to venereal infection. A slight ulceration of the schneiderian membrane no doubt frequently arises from catarrh, and may also follow a blow; but none of these causes are adequate to produce an ulcer of such a malignant character as ozæna, if the constitution is sound. The ulcer often occurs without any very obvious cause, and must in that case be ascribed to some constitutional disease; but I suspect that it is more frequently connected with syphilis than is generally imagined. From its occurring often in children, and in those who have never been exposed to syphilitic infection from sexual intercourse, ozæna has not generally been ascribed to a venereal origin. Boyer, indeed, asserts that ulcers of the pituitary membrane are never primitive, nor produced by the immediate application of the syphilitic virus to that membrane, but that when a venereal ulcer appears in this situation, it is always a secondary disease, following a general contamination of the system. I apprehend that every practical surgeon will agree with me, that venereal ulcers are not unfrequently produced in the nose by the direct application of the syphilitic virus to the schneiderian membrane; and this happens from a patient applying his finger inadvertently to the nose while dressing sores upon the penis. I had lately under my charge two children in whom the ozæna was followed by very destructive consequences. They lived upon the same floor with a man understood to have lues. The youngest girl, about seven years of age, had picked up in the passage an old handkerchief which belonged to him, and which she kept in her possession for some time. Soon after, an ulceration appeared in her nose, but before medical assistance was procured, or the nature of the disease understood, the septum was destroyed, and several of the bones were carious. The elder sister, eleven years of age, was soon after attacked in a similar way, and the ulceration was attended with the same destructive consequences. These two children slept together, and were the only ones of the family who suffered. The ulceration in the youngest child was cured by the internal exhibition of mercury, combined with local applications of the ointment of the red oxide of mercury and a solution of the sulphate of copper; but there long remained some carious bones, and at the distance of some months she was seized with pectoral complaints, under which she gradually sunk. The elder sister still remains under treatment.

## TREATMENT OF OZÆNA.

As ozæna is always connected with a diseased state of the system, in its cure we pursue both a local and constitutional treatment. From whatever cause the ulcer originates, whether connected with syphilis or not, whenever it is inflamed, the increased action should be allayed before we attempt the use of any caustic, otherwise we are in danger of augmenting the irritation, and extending the ulceration. The inflammation is best subdued by warm opiate and saturnine fomentations, which should be used three or four times a-day, while we apply to the nose a saturnine poultice through the night. During the use of the fomentations, the best dressing is fine scraped lint inserted into the nostril. This absorbs the ichorous discharge, and prevents it excoriating the neighbouring parts. When the inflammation has subsided, we give up the fomentations and poultices, and then the most useful application is the ointment of the red oxide of mercury, which is best applied by means of a hair pencil, at the same time that a bit of lint is inserted into the nostril besmeared with it. While we dress with this ointment, the ulcer may be occasionally touched with the nitrate of silver, or the sulphate of copper; or it may be washed with a solution of the muriate of mercury, in the proportion of one grain of the salt to two ounces of water. When the ulcer has begun to heal, perhaps one of the best local remedies is the occasional application of a bit of lint, wet with a solution of the sulphate of copper, in the proportion of five grains of the salt to an ounce of water.

In deciding upon the constitutional treatment, the surgeon should endeavour if possible to trace the disease to its origin. If it is suspected to depend upon syphilis, the patient should at once be put upon a course of mercury, to be pushed till it exerts visible effects upon the system. If the disease cannot be traced to a syphilitic origin, it is better to combine antimony with the mercury, and a good form of using the medicine is that of Plummer's pill, or the compound pill of the submuriate of mercury of the Edinburgh Pharmacopœia, one of which should be taken evening and morning. It will be advantageous to use at the same time the compound decoction of sarsaparilla. After these medicines have been used for some time, they may be changed for the nitric acid, or for the preparations of iron, the use of which is sometimes attended with the best effects.

As far as I am able to judge, caustics have been too indiscriminately used in the treatment of ozæna, and to this practice I ascribe the frequent failure of the cure of this disease.

## POLYPUS OF THE NOSE.

NASAL POLYPUS is a tumor arising from some part of the schneiderian membrane, generally high in the nose. It gradually increases in size, extending backwards into the fauces, and ultimately protruding at the nostril. In its progress, it destroys the sense of smell, and when the nostril is filled with the tumor, the breathing becomes obstructed, and the disease in this stage is accompanied with many distressing symptoms. But in its early stage, it is attended only with stuffing of the nose, sneezing with watery eyes, and is in general free of pain. When the polypus is firm, in proportion as it enlarges it compresses the bones, presses the septum to one side, and closes up the sinuses, by which the clearness of the voice is lost. It descends into the anterior nostril, projecting externally, and extends backwards into the throat, shutting up the Eustachian tube, and causing deafness. The destructive effects of the polypus are in proportion to its consistence. The soft polypus may remain for years without materially injuring the structure. When firm, it presses upon the ethmoid bone so as to produce headach and stupor; and, in the latter stages of the disease, it forces up the nasal bones, and so completely obstructs the breathing, that the patient sleeps with his mouth open. By its pressure on the membrane and bones, it excites ulceration, causes caries, and is then attended with a fetid discharge, exhibiting every symptom of malignity. Withall, it is frequently accompanied with attacks of hemorrhage, sometimes so severe as to induce fainting.

Nasal polypus occurs as frequently in the female as in the male, and in youth as in manhood or old age. It is not particularly observed to follow any external injury or disease of the constitution, but by some writers is said to be most apt to occur in those who have been liable to attacks of catarrh. In some cases, the disease does not recur, in other instances it returns shortly after it is extirpated. In general, both nostrils are affected, and there are many tumors; indeed, sometimes the schneiderian membrane is so thoroughly diseased, that polypi exist in the frontal sinuses, in the nose, and in the antrum at the same time.

Nasal polypi are neither all of the same colour nor of the same hardness; sometimes they are pale and soft like coagulating lymph, at other times of a dark red colour, and hard like a scirrhous tumor. Betwixt these extremes there are various degrees of intermediate consistence.

We may reckon three species of nasal polypus.

The first is a tumor transparent like mucus, possesses little vascularity, and is so soft as to break under the forceps like jelly. Polypi of this kind are commonly in great numbers, are attended with little or no pain, are troublesome, chiefly from the obstruction they give to the breathing, and vary in size according to the state of the atmosphere. When the weather is damp, they descend and appear externally, but in dry weather retire within the nostril. The second species are of a firmer consistence, much more vascular, and are in general attached by a slender pedicle. They are so firm that they can be grasped by the forceps, bleed freely when torn away, and from their pressure soon destroy the membrane and bones. The polypi of the third kind are so firm as to feel hard to the touch, and are of a dark red colour. They are attended with pain from their commencement, and are subject to profuse discharges of blood. These polypi are not affected by the changes of the atmosphere, are attached by a broad base, and generally return after removal.

The ancients were of opinion that there was a species of polypus which was cancerous or malignant. Mr. Pott has adopted the same sentiment. He conceives that there are two species of the disease, the one benign and the other malignant; that the benign should be extirpated, but that we should not interfere with the malignant, as tending to aggravate the disease. Mr. J. Bell denies the inherent malignity of polypus, believing every such tumor to be at the first of a harmless nature, and that it only exhibits symptoms of malignity in the course of the disease, arising from bulk and pressure. But in confirmation of the opinion of Mr. Pott, I may observe, that the hard and dark red polypi are attended with pain long before there is any pressure on the bones, and that even when completely removed, and their roots destroyed by the actual and potential cautery they still return; whereas, when the soft polypi are extirpated, a complete cure is often effected without having recourse to these measures.

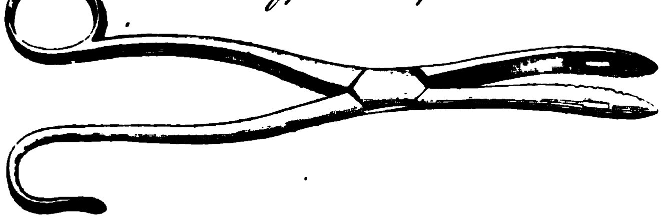
## TREATMENT OF NASAL POLYPUS.

Whether polypus be benign or malignant, every attempt should be made to remove it, as when the disease is permitted to run its course, it ultimately ends in a painful death.

Four methods have been practised for its removal, viz. Extraction, Ligature, Excision, and Caustic. All of these methods may occasionally be employed, but are not equally applicable to every species of polypus, one being preferable to another according to the length of time the disease has subsisted, to the exact situation of the tumor, to its consistence, to the extent of its base, and to various other circumstances.

**Extraction.**—Extraction is an ancient method employed for the cure of nasal polypus, and is now generally adopted in every condition of the disease. But when the tumor is attached by a broad base, there is danger of denuding the bone to a considerable extent; and when situated high in the nostril, and more especially if of long continuance, there is a risk of bringing away part of the ethmoid bone, which may be followed by inflammation of the brain. This method of cure must therefore be used with caution. When the surgeon has recourse to it, he should endeavour to grasp the polypus as near its root as possible, not only that it may be more effectually extirpated, but to prevent it breaking, as this is apt to be followed by a troublesome hemorrhage. The patient must be seated on a chair fronting a clear light, with his head reclining on the breast of an assistant. The surgeon then introduces the polypus forceps, sliding their blades along the polypus till he reaches as nearly as he possibly can its point of attachment,

Polypus Forceps



which he grasps firmly; and instead of pulling directly downwards, he must, by turning the forceps, twist and tear the tumor from its root. If the polypus has a slender root, it in general comes easily away, and if not of a very firm consistence, there is seldom any hemorrhage. When a hemorrhage succeeds, it most commonly happens from the polypus breaking, and the most effectual way to check it is again to introduce the forceps, and continue extracting till the whole is brought away. If the hemorrhage should still continue, which is seldom the case, and if cold affusion and plugging the anterior nostril prove ineffectual, the surgeon must have recourse to the method which is described for the stoppage of nasal hemorrhage. When the surgeon has removed the tumor with which he has been engaged, he must carefully examine the nostril, lest there should be any other, which, passing unobserved, would bring the patient in a short time into the same distressing situation.

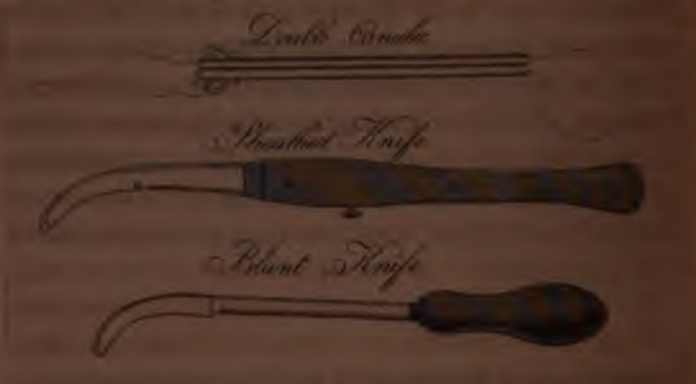
Of all the species of nasal polypus, the forceps seems best adapted to the first, and they should, in this case, be used with a view to squeeze and destroy its texture, at the same time bringing as much of the tumor away as possible. When this object has been effected, the cure will be easily completed by the caustic. Extraction may also be had recourse to, for the cure of the second species of polypus, although it appears to me that excision is a preferable method, as less injurious to the structure of the parts. In the third species, where the tumor is hard, and attached by a broad base, extraction is liable to be followed by a troublesome hemorrhage, and what is worse, the Schneiderian membrane is extensively lacerated, and portions of the bones are apt to be brought away.

**Ligature.**—Glandorpius strongly recommended the employment of the ligature, for the removal of nasal polypi, and the practice was followed by Heister; but this method of cure has been principally resorted to by Levret, and the surgeons of the present day. Levret gave up the method by extraction, which was the operation generally performed in his time, chiefly on account of the subsequent hemorrhage, and betook himself to the ligature. There is difficulty in its application. In its action the ligature is slow, and when the nostril is filled with the tumor, its use is impracticable, at least it will be impossible to noose the tumor close by the root. The best way of applying the ligature, is by means of a double canula. The surgeon takes a double canula about four or five inches in length, passes through it a silver wire having a pretty large noose at the further extremity, and then fastens one of the loose ends of the wire to one of the rings at the lower end of the canula, as represented in the plate at page 246. Catgut is sometimes used for the ligature, but wire is preferable, because it does not soften and bend in the nostril, and from its firmness it can be the more easily carried over the polypus. When the canula is thus armed, he passes it into the nostril and carries it along the palatine plate of the maxillary bone, back towards the throat. An assistant now seizes the tumor with a pair of small dressing forceps, and brings it as low down in the nostril as possible. While it is held in this situation, the surgeon endeavours to carry the noose over the polypus, and by the help of a probe to conduct it to its root, which is generally high in the nostril. When he thinks he has effected his purpose, he draws the loose end of the wire towards him through the canula, with a moderate degree of tightness, so as firmly to grasp the root of the polypus, and then fastens it to the ring on that side of the instrument. The canula being allowed to remain, the circulation is obstructed in the polypus, which inflames, swells, gangrenes, and thus fades under the ligature.

Immediately after the tightening of the ligature, the pain is very severe, and generally continues for two days. A discharge soon takes place from the nostril, the ligature by the fading of the polypus becomes slack, and, as it slackens, must from day to day be tightened, by loosing its end from the ring of the canula, and pulling it so as to make it more firmly embrace the root of the tumor.

Although to all appearance the ligature is a very simple and effectual method of removing nasal polypi, it is quite otherwise in practice. From their deep situation, it is difficult to engage them in the ligature, and almost impossible to embrace them close by the root. Besides, these tumors are in general numerous, a circumstance which is also unfavourable to this mode of cure. When there is only one tumor, or when the polypi are very few in number, and situated in the throat, or when the tumor arises from the posterior part of the nose, and projects backwards into the fauces, it can be more easily noosed than when it descends into the anterior nostril; the ligature is therefore better adapted to polypi of the throat, or of the posterior nares, than those which are situated high in the nostril, or which descend forwards. Boyer acknowledges that the ligature is difficult of application; and both Lassus and John Bell have seen practitioners of reputation fail in it. Besides, when the surgeon does succeed, the ligature is extremely painful, as well as slow in its action; and the Schneiderian membrane frequently extensively inflames; the inflammation extending to the eyes, sinuses, and throat, and producing violent headach and fever.

Excision.—Excision is an operation applicable to every species of polypus. The objections that have been urged against it are the subsequent hemorrhage and the injury which is liable to be done to the sound parts of the nose. When the polypus is firm, there may be considerable hemorrhage if cut far from its root; but if the incision is made close by the root of the tumor, any bleeding that may follow will in general be inconsiderable, and easily suppressed by introducing a plug of lint into the nostril, directing it so as to press upon the point from which the tumor has been removed. However, if this should fail to suppress the hemorrhage, it may be readily stopped by the introduction of the compress and ligature recommended for the suppression of nasal hemorrhage. When the surgeon has recourse to the method of excision for the removal of nasal polypus, he should, to prevent injury to the sound parts, employ the sheathed knife, constructed on the principle of Wiess's hernia knife;

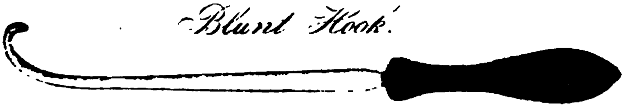


or he may use the curved knife, which has a blunt edge, but will easily remove a polypus that has a narrow base, and is not of a very firm consistence. There is less danger of hemorrhage from the use of this instrument than from a sharp edged knife, as it rather separates than cuts.

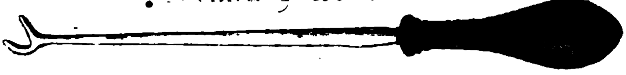
Some of the largest polypi on record have been removed by excision, such as one described by Mr. Manne of Avignon, and another by Mr. Whately. In excision, there is no danger of extensive laceration of the Schneiderian membrane, or of the removal of any portion of bone; and it is more effectual than the ligature in destroying the disease.

CAUSTIC.—The actual and potential cauteries were much employed by the ancients in the cure of nasal polypus. In those cases where the polypi are small, soft, and of the mucous kind, they may be effectually destroyed by caustic; and where extraction, the ligature, or excision has been employed, it is frequently necessary to have recourse to it, in order completely to destroy the roots and prevent the reproduction of the disease. There have been various contrivances for the introduction of caustic into the nose. I at one time employed a curved silver canula of a large diameter, filled with lunar caustic, and having an opening on one side, by which means the caustic was more directly applied to the polypus; but I now use a large caustic bougie, and find it answer every purpose. I have said, that the use of the caustic is more applicable to the soft than to the hard polypi; and these will be more readily destroyed, if their texture has been previously broken up by squeezing them with the forceps. In pursuing this method of cure, the surgeon seats the patient before a clear light, with his head reclining backwards upon the breast of an assistant. He now introduces into the nostril the forceps, with which he grasps and squeezes the polypus so as to destroy its texture. Withdrawing the forceps, he pushes in a bit of dry lint, by means of a probe or other blunt instrument, to clear away the bloody mucus; then inserts a large bougie armed with lunar caustic, which he pushes backwards and forwards several times in the nostril with little ceremony; and upon withdrawing it, he again employs a bit of dry lint, to absorb any moisture which might excoriate the nostril; finally, upon removing it, he introduces a plug of lint, which is kept in for two or three hours, till the effects of the caustic are completely gone. The application of the caustic should be repeated every second day, and it is of no consequence whether it be applied to the root or body of the polypus, as it is equally successful in its destruction. The inflammation produced by the caustic is in general trifling, and very limited in its extent; but sometimes it spreads along the mucous membrane, so as to produce pain in the forehead, the face, and in the throat. The caustic should not now be reapplied till the inflammatory symptoms subside, which is generally in the course of a few days. When caustic is used to destroy a portion of a polypus, remaining after extraction, the ligature, or excision, the nostril must be cleared and plugged with dry lint, in the same manner as when used for the soft polypi; and in this case the surgeon should endeavour to apply it as near the roots of the tumor as possible.

Polypus is not a disease suited for a display of surgical skill. Although I have described four methods which may be resorted to for its removal, and endeavoured to point out the forms of the disease to which each method is applicable, still no very definite directions as to their employment can be laid down. On some occasions, it may be necessary to have recourse to all of them, and, at other times, even to such as do not appear very scientific, as nothing should be left untried, however coarse it may be, to remove so fatal a disease. In many cases, the blunt hook and the forked probe represented in the plate, will be found very useful in clearing the nostril.



Blunt Hook.



Forked Probe.

## NASAL HEMORRHAGE.

HEMORRHAGE from the nose is very frequent in youth, and sometimes occurs in place of menstruation. In some constitutions, there is such a determination of blood to the head, that bleeding from the nose takes place upon the slightest exertion, especially in warm weather. People of this idiosyncrasy are very subject to headach, which the hemorrhage never fails to relieve. It will be proper, in such constitutions, if the discharge is frequent and profuse, to moderate it, although not advisable altogether to suppress it, which might tend to produce apoplexy or mania. In debilitated constitutions, this hemorrhage may be dangerous, and requires to be suppressed. When the usual means fail, viz. cold affusions, and plugging up the nostrils with dossils of lint immersed in styptics, the hemorrhage may be very effectually stopped in the following manner: Take a surgeon's probe or a piece of wire with a loop or eye upon one end of it, then take a ligature composed of two or three threads well waxed, put one end of the ligature through the eye of the probe or wire, and thus armed, convey it through the bleeding nostril into the throat, make the patient open his mouth, and when the ligature is discovered behind the velum, seize it with a pair of forceps and bring it out, then withdraw the wire. Take now a small dossil of lint, and tie it in the middle to that end of the ligature which is hanging out at the mouth, after which place it upon the fore and middle fingers of the left hand, and convey it backwards towards the throat, at the same time drawing the ligature with the other hand slowly through the nostril. After the dossil of lint has been conveyed beyond um, it is to be suddenly pulled up into the erior nares, which will effectually close it. The anterior nostril must also be plugged up by a bit of lint. By this means, any hemorrhage, however profuse, may be readily stopped; and when all danger is over, the plug of the anterior nostril is to be withdrawn, and that in the posterior is to be pushed back into the throat, by means of a director or a pair of dressing forceps, and then removed by the mouth.

## SECTION II.

### DISEASES OF THE ANTRUM MAXILLARE.

The nose and antrum being lined by one common membrane, the diseases to which these parts are subject must be of a similar nature; but from the antrum being a concealed cavity, its maladies will be longer of being detected, less accessible, and hence less curable than those of the nose. The chief diseases of the antrum which claim our attention are abscess and tumors, or polypous excrescences.

### ABSCESS OF THE ANTRUM.

The lining membrane of the antrum sometimes inflames, from cold, from caries of the teeth, from injury in the extraction of a tooth, or from some less obvious cause; and the inflammation, like that situated in other mucous membranes, terminates in a secretion of pus or in ulceration. Abscess of the antrum commences with a severe pain at the root of one or more of the molares situated under this cavity. The pain resembles toothach, extends upwards to the cheek, and exists for a long time before any swelling takes place, or before there is any uneasiness on pressure. The violence of the pain abates, the cheek then swells, becomes hard, and feels tender when pressed on. At this time the antrum is filled with pus, which generally flows from the corresponding nostril, when the patient lies on the opposite side; but as there is not a free discharge for the matter, the antrum enlarges, the bone forming its anterior walls becomes so thin and soft, that it yields under the fingers, and when pressed on, the pus flows freely from the nostril. The cheek now ulcerates in one or more points, by which the matter is discharged, the openings become fistulous, and a probe can be passed through them into the antrum. The molares corresponding with the cavity sometimes become loose, and the matter is discharged by their sockets; at other times an opening is formed in the palate, which gives vent to the pus, although it is most commonly discharged by the cheek. In this advanced stage of the disease, the bones are generally carious, and when this is the case, the breath is intolerably fetid.

## TREATMENT OF ABSCESS OF THE ANTRUM.

When the antrum is found to contain matter, an opening should be immediately made into it. This should be done at the most depending situation, and a cure will be more or less easily effected in proportion to the period at which the matter has been evacuated, and to the freedom of discharge. From inflammation of the antrum being apt to be mistaken for toothach or rheumatism, this cavity is frequently much enlarged, its walls become carious, and even the cheek has ulcerated before the true nature of the disease is discovered. The discharge of the matter through the cheek is always followed by an alleviation of the symptoms, but as no opening in this situation is sufficiently free, it is seldom followed by a cure of the disease.

When the bones are not carious, the best situation to perforate the antrum is from the socket of one of the molares corresponding with that cavity; but, if the bones are extensively diseased, a much freer opening is required, and in this case it will be necessary to separate the lining membrane of the cheek, and make an entrance into the lower and fore part of the antrum immediately above the alveolar processes. In the first of these states of the disease, if any of the molares corresponding with the cavity be loose or carious, it will be preferable to extract it; but, if not, the third or fourth grinder is the tooth which should be removed, as pressed down, forming a tumor in the mouth; and while this destructive process is going on, the teeth corresponding with the antrum become loose, and fungous excrescences frequently appear at their sockets.

The presence of this disease may be suspected, from pain resembling toothach occasionally darting through the cheek to the orbit, from a fulness and uneasy feeling in the corresponding nostril, with frequent profuse bleedings from that side of the nose. When the disease has made some progress, its existence may be fully ascertained by swelling of the cheek, weeping of the eye, a loosening of the molares of the affected side, and a fetid discharge from the nostril when the cheek is pressed on, or when the patient lies on the opposite side.

## TREATMENT OF TUMORS IN THE ANTRUM.

When tumors are known to exist in the Antrum, there is but one mode of procedure which can be of the smallest service, viz. to expose the cavity freely, and to cut the tumors away, destroying their roots by means of the actual and potential cauteries. To give the surgeon a perfect command over the disease, the cheek should be laid open by an incision, commencing a little below the orbit and carried down to the commissure of the lips; the soft parts are then to be dissected back so as to uncover the bone, which will generally be found so soft or carious that it may be cut with a scalpel. Indeed, in some cases, the bone is so completely destroyed, that the tumor comes into view as soon as the cheek is laid open. If the disease has not made so much progress as to affect the bone, the antrum must be opened by placing a small crown of a trephine immediately above the roots of the third and fourth grinders; and the tumor may be farther uncovered, either by re-applying the trephine, or breaking down the bone by cutting instruments. When the antrum has been freely opened, the tumor must be removed by the fingers and the scalpel. The hemorrhage, which is frequently considerable, can in general be stopped by compression with lint or the sponge; if not, the actual cautery must be applied, which will also have the effect of more completely destroying the disease. The actual or the potential cautery may be frequently required to be applied, either to extirpate the disease, or to prevent any tendency to return. The wound must, therefore, be left open, that the surgeon may have free access to the antrum. When the disease is eradicated, the antrum begins to fill with healthy granulations, and the opening into it gradually closes up. The edges of the wound in the cheek should now, with a view to re-union, be rendered raw, brought into contact, and retained by the hare-lip suture.

As this disease, when left to itself, always proves fatal, every means should be employed to extirpate it; but I am sorry to observe, that in six cases which I have seen, or been concerned in, a cure was only effected in one of them. In the other five the disease was either not removed, or after a time returned.

# CHAPTER XVII.

## DISEASES OF THE MOUTH.

### GENERAL REMARKS ON THE STRUCTURE OF THE MOUTH.

The mouth is lined by a membrane, which is a continuation of the common integuments. This membrane is of a mucous structure, connects the cheeks to the jaws, and forms the ligaments of the lips and tongue. The gums, which are very firm and vascular, are of the same nature with the periosteum, and materially assist in fixing the teeth. A continuation of the same substance extends backwards, covering the palatine plates of the upper jaw and palate bones. It adheres to these bones as firmly as the gums do to the teeth, and terminates in the soft palate or velum pendulum palati, which hangs from the back part of the roof of the mouth. This pendulous curtain is beset with many glands, and serves the purpose of a valve, preventing liquids, in the act of swallowing, from passing upwards into the nose, and, in speaking, forcing as much of the breath through the nose as to give the voice its tone and harmony. From the centre of this curtain hangs a small glandular body, called the uvula, from which there proceed two arches. The anterior arch, which is the first that we see upon looking into the mouth, passes down on each side, to be implanted into the root of the tongue, and forms the isthmus faucium or opening into the throat; while the pillars of the posterior arch depart backwards, to be inserted into the side of the pharynx. Betwixt these arches lie the large mucous glands of the throat, called the tonsils. When these glands inflame, they are pressed betwixt the arches, in the act of swallowing, which is productive of great pain; their secretion becomes so viscid and thickened as to collect on their surfaces, forming crusts; and, by the inexperienced, these are apt to be mistaken for ulceration of the throat.

The chief bulk of the tongue is formed of muscles covered by a cellular substance, and then surrounded by the membrane of the mouth, which, after lining the cheeks and lips, turns off to give a covering to the tongue. The sense of taste resides chiefly in the papillæ towards the point, and on the sides on the fore part of the tongue; while the tubercles on its back part are the openings of excretory ducts belonging to innumerable glands situated near its root. It is towards the back part of the tongue, and in the course of its glands, that we perceive the thickened mucus in fever.

What is chiefly worthy of the attention of the surgeon, in investigating the structure of the mouth, is the numerous glands and follicules by which its secretions are supplied. 1st, The lower jaw, from ear to ear, is surrounded by a chain of large glands, which secrete the saliva, and pour it into the mouth by distinct ducts. The parotid duct perforates the cheek, and enters the mouth opposite to the second molares of the upper jaw. The termination of the submaxillary duct is seen on each side of the frenum linguæ, and the sublingual gland pours its fluid in by many small ducts under the point of the tongue; 2d, The soft palate and the root of the tongue abound with many glands; 3d, The tonsils lying in the fauces, betwixt the two arches in the throat, give out their mucus by fifteen or twenty openings; and 4th, The whole internal surface of the cheeks and lips is so beset with glands, that we cannot put down the point of a pin without touching some of them. They are like millet seeds with invisible openings, and, although they cannot be shown by dissection, they can be distinctly felt upon the introduction of the finger into the mouth, especially when under salivation, at which time they are hard and like pin heads. It is one or more of these little glands that become first affected in cancer of the lips and cheeks.

## SECTION I.

### DISEASES OF THE LIP.

A MALCONFORMATION of the upper lip is not an uncommon occurrence, and a fissure in the lower one is frequently met with in practice. The first, from its resemblance to the lip of a hare, has been termed the hare-lip; the latter is always the consequence of external injury. Independently of these defects, the lips, from their glandular structure, are particularly liable to cancer; and they are sometimes attacked with tumors and warty excrescences, which are apt to degenerate into that disease.

### HARE-LIP.

CHILDREN are sometimes born with a fissure or cleft in the lip, which, as just now observed, from its resemblance to the lip of a hare, is called the hare-lip. This affection is always confined to the upper lip, and does not depend upon a loss of substance. Its size is regulated by the action of the muscles, and hence, in consequence of the retraction of its edges, the defect is more conspicuous when the child laughs or cries. This malformation is of various extent. Sometimes a portion of the lip only is affected; at other times it extends into one of the nostrils, which has then a flattened form, and is much enlarged. The fissure is most commonly single, but sometimes it is double, having an intervening portion of the lip betwixt the fissures. It is also occasionally attended with a cleft or division in the palate, and palatine plates of the superior maxillary, and palate bones; the fissure, in some cases, even extending as far back as the uvula. When the hare-lip is single, this is sometimes the case; but it is almost always so when it is double. In this separated state of the bones, one or two of the incisors often project, or there is a projecting part of the jaw, one side of the bone being placed on a higher level than the other. When there is a cleft in the jaw, the child sucks with extreme difficulty, as the milk escapes through the opening, and passes up into the nose. This defect is also attended with very imperfect articulation.

When a fissure occurs in the lower lip, it generally arises from a wound, the opposite edges of which have either not been brought into contact or have not adhered, in consequence of some unhealthy state of the system. I had once under my care a boy, about nine years of age, with a fissure in the lower lip, produced by inflammation and sloughing, from the use of calomel in scarlatina. I rendered the edges of the fissure raw, brought the cut surfaces into accurate contact, and retained them in that situation by means of the twisted suture; but they did not adhere. The operation was performed about a month after every visible appearance of the influence of mercury was gone, and, at the end of six weeks, I repeated it with the same want of success. Although it was now upwards of three months since this patient had taken any mercury, it appeared that he still laboured under a state of system unfavourable to adhesion. No farther operation was therefore attempted; but he was sent home to Orkney, from whence he came, with a recommendation that no other trial should be made for a year or more, when a change would most likely have taken place in his habit of body.

## TREATMENT OF HARE-LIP.

The hare-lip can be cured only by an operation, which consists in cutting away the edges of the fissure, bringing the cut surfaces together, and retaining them in that situation by means of the twisted suture till they unite, and this they very readily do. The edges of the fissure may be cut either with a scalpel or a pair of very fine scissars, but the former is the preferable instrument, as there is less risk of contusion. The lip should first be separated freely by incision from the jaw; care being taken not to separate too much where there is no great thickness of soft parts, as it often happens that the lip is very thin at the point of adhesion. A piece of pasteboard, or a flat thin piece of wood should now be inserted betwixt the lip and the jaw; and, by stretching the lip upon it, the edges of the fissure may be easily cut off by the scalpel, so as to leave a bleeding wound of the form of the letter A. The surgeon should be particularly careful that the fissure be rendered raw throughout its whole extent, otherwise there will still remain an opening, from this impediment to adhesion; the opposite surfaces are now to be brought together, and a common sewing needle passed through the vermilion part of the lip; a ligature is to be twisted round the needle in the form of the figure 8, so as to retain the parts in contact; and a second needle is then to be passed, in a similar manner, at some little distance from the first, and nearer the nose. There will seldom be a necessity for a third needle, but this must be used if the surgeon finds that all the track of the incision is not in contact. After each needle is passed, the ligature must be carried round it, as was done with the first, and the whole secured in the manner as described in pages 363 and 364 of vol. 1st, and represented in the accompanying marginal plate. In using this suture, in all wounds of the lip the first needle should be passed at the vermilion part, in order that the surgeon may be enabled to bring the corresponding surfaces perfectly in contact. Each needle should be entered at some little distance from the edge of the wound, and always carried two-thirds through the thickness of the lip, by which the posterior edges will be brought together, and hemorrhage prevented by the pressure of the opposing surface on the cut coronary artery.

If the hare-lip is double, and there is only a small button or projecting point betwixt the fissures, it will be better to cut it away and then bring the outer edges together; but if the intermediate piece is considerable, it will be more advisable to allow it to remain, and to perform two operations, taking care that the adhesion of the one fissure be perfect before we attempt the other. When any of the incisors projects so far as to interfere with the adhesion of the lip it should be removed. When there is any projection of the jaw, or when one side is situated on a higher level than the other, it has been customary, in the first instance, to cut off the projecting point, and, in the second, to employ pressure to force it inwards, but there is no necessity for having recourse to either of these measures. In all the cases that I have seen, a short time after the cure of the fissure in the lip, the raised bone took a new direction of its own accord, and gradually turned inwards, till it met its fellow of the opposite side.

When there is a division in the jaw, if the operation is performed in infancy, the cleft gradually lessens, the bones come together in the course of years, and at last are firmly united., This is a motive for performing the operation early, whereas, if not done till adult years, the bones generally remain separate, and the defect requires then to be remedied by an artificial palate. But although we have recommended an early operation, it should never be performed when the child is at the breast, because, from the irritability of constitution in very young children, they are liable to be attacked with convulsions, and the process of sucking would interfere so far as to endanger the separation of the lips of the wound.

## CANCER OF THE LIP.

The lips are very subject to cancer.. The lower lip is more frequently attacked with this disease than the upper. It commonly begins in the form of a small wart, which remains stationary for many years, till, being bit with the teeth, or otherwise bruised, it ulcerates, and becomes a painful spreading sore. Sometimes there is merely a scab, which the patient picks off from time to time, but, although its removal leaves a tender bleeding surface, the scab is shortly reproduced, and it is long before there are any farther marks of disease. Cancer of the lip also not unfrequently presents itself in the form of a small ulcer with a hard base and indurated edges, and manifests no disposition to heal, but remains stationary, till, in consequence of some irritation, it begins to spread; the adjacent parts become of a bluish or copper colour, and hard;

and the lymphatic glands under the jaw swell. During the progress of the ulceration there is a profuse discharge, generally of a brown colour, and attended with a burning pain. When the whole lip is destroyed, the patient can neither speak distinctly nor retain his saliva, which flows perpetually over the chin.

Ulcerations of the lip occur most commonly in the lower ranks of life, and are particularly frequent amongst the Highlanders of Scotland; but, independently of any cancerous affection, these sores are often prevented from healing by being irritated in the motions of the part; and I believe that extirpation is often performed where there is no malignant disease. In such a case the patient continues well, and this has given rise to an opinion that cancer returns less frequently after excision of the lip than after that of any other part.

## TREATMENT OF CANCER OF THE LIP.

Malignant ulcers of the lip, like those of the cheek and nose, may frequently be cured by caustic, but the preferable plan of treatment is the knife, as it at once removes the disease. The operation consists in cutting out the affected portion, of a triangular form, so as to leave a wound, whose opposite surfaces can be brought so accurately into contact that when healed there may be little deformity. When the cancerous portion is removed, the remaining steps of the operation are precisely the same as for the hare-lip ; but, although it is an object of the first importance to remove all the disease, the surgeon should recollect, that if the parts are put much on the stretch, the inflammation will be so great that they will ulcerate and not adhere.

In cutting out the diseased part, some surgeons employ a pair of curved forceps to steady the lip and guide the knife, but it can be as easily and accurately done by cutting it upon a flat piece of wood, and by this method there is less danger of bruising the parts. When the operation is completed, the patient, to insure the adhesion, must not eat, speak, or move the muscles of the face, but be supported by liquid nourishment conveyed by the spout of a tea-pot or jug. After the adhesion is effected, and the surgeon wishes to withdraw the needles, he will find that by oiling them he will accomplish his purpose with much greater ease than if he neglect this step.

In the summer of 1822, a case presented itself at the Royal Infirmary, in which there was an extensive ulceration of the lower lip and of the angle of the mouth. I removed the ulcerated parts, carrying my incision for some way along the cheek, on a line with the upper lip ; then downwards, so as to meet the incision which separated the lower lip. The cut surfaces were brought together, and retained by the needles and ligature ; but, from the parts being much on the stretch, so great a degree of inflammation followed, that I was obliged to remove the two needles which secured the lower lip to the angle of the mouth. In consequence of the removal of the needles, a large gap was left in the lip, but, under the application of poultices, and afterwards of simple dressings, granulations sprang rapidly up so as in a great measure to supply the deficiency, and the lining membrane of the mouth uniting with the skin over the new formed parts, there remained little deformity, and the patient completely retained the saliva.

Richerand,* from observing that the lip may be regenerated, directs the diseased portion to be removed by an incision in the form of a long crescent, and, after securing the bleeding vessels by ligature, to dress the wound as an open surface, and heal it by suppuration and granulation. In cases, therefore, where the disease is extensive, instead of cutting out a triangular piece and bringing the cut surfaces together, which would place the parts so much on the stretch as to create great pain and endanger the adhesion, it seems to be a preferable practice to perform the operation in Richerand's manner. But when there is no great extent of disease, the immediate union is to be preferred, as occasioning less deformity, and making a quicker and more perfect cure.

It is hardly necessary to observe, that when the lymphatic glands under the jaw are affected, no operation should be performed unless they can also be removed.

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* Nouv Proc. pour l'Extirp. des Canc. aux Lèvres. Annuaire Med. Chir.

## SECTION II.

### DISEASES OF THE TONGUE AND SALIVARY DUCTS.

The tongue, like the lip, is subject to a congenital affection, by which its point is so confined that the child cannot suck. It is also very liable to cancerous ulcerations; and the salivary ducts opening into the mouth under it are sometimes so distended as to form large tumors, displacing the tongue, and impeding both the swallowing and articulation.

### DIVISION OF THE FRAENUM LINGUAE.

When a child sucks with difficulty, parents generally imagine that it arises from the tip of the tongue being fixed down by its ligament, the fraenum; whereas it is often attributable to other physical causes, such as the size of the nurse's nipple, or the natural weakness of the child. When a child is long of speaking, or articulates imperfectly, it is also so customary to ascribe it to this defect, that a surgeon is frequently solicited to divide the fraenum linguae. This operation is not without danger, and should be practised with caution. Cases are recorded by Dionis, Palfin, and

Petit, where, in consequence of the division of the ranine artery, the patient died of the hemorrhage; and the latter writer relates some cases which occurred in his own practice, where, from the extensive division of the frænum, the tip of the tongue was sucked back into the throat, so as to produce suffocation. Wherever the child can suck, the operation of snibbing the ligament ought not to be performed. But where this is not the case, and the surgeon, upon examination, finds the frænum extending to the tip of the tongue, it may be divided. The operation is simple in itself, and should be done with a pair of small scissars, having blunt points. The surgeon, in cutting, should keep at some distance from the tongue, directing the points of the scissars downwards towards the lining membrane of the mouth, and dividing to no farther extent than what is just sufficient to set the tongue free.

## CANCEROUS ULCERATION OF THE TONGUE.

The tongue is liable to be attacked with ulceration, both of a benign and malignant nature. The former is generally situated on the sides of the tongue, and is most commonly produced by the spicula of a carious tooth. Although of a benign nature, this ulcer will not heal till the irritating cause is removed, which may be effected either by extracting the tooth or filing off the projecting point. But the most alarming species of ulcer is that which appears on the surface or edge of the tongue, preceded or accompanied with hard tubercles and deep sulci. The edges of the ulcer are hard, and the surrounding parts of a livid colour. It discharges a bloody sanies of an intolerable fetor, and there is a continual flow of saliva. The disease makes rapid progress; but, before the ulceration has advanced so far as to destroy much of the tongue, the lymphatic glands under the jaw inflame and swell, and, as the ulceration proceeds, there take place repeated discharges of blood.

## TREATMENT OF CANCER OF THE TONGUE.

When the cancer is situated towards the point, or on the sides of the tongue, it may be removed either by ligature or by the knife. The application of a ligature to this organ produces less pain than in any other part of the body, and also prevents danger from hemorrhage. The practice was first recommended by Sir Everard Home, and has since been employed by other surgeons. The method of passing the ligature is described under the treatment of cancer, vol. i. p. 279. The ligature is generally passed by a common surgical needle, but will be far more easily by means of a hafted needle, which is just a tenaculum with an eye in its point.

When the knife is employed in the extirpation of cancerous portions of the tongue, the surgeon should first insert a piece of wood betwixt the teeth, to keep the mouth open; he then strikes a tenaculum into the diseased portion, and cuts it out with the scalpel. Any hemorrhage must be suppressed by the actual cautery, which will also assist in more completely destroying the disease.

In those cases, where, from the seat or extent of the disease, the ligature and knife are inadmissible, there is no alternative but the actual cautery; which, however alarming it may appear, is surely preferable to the cutting out of the tongue,—an operation which can be mentioned only with horror, and to which a profuse hemorrhage, difficult to command, will most certainly succeed.

## RANULA.

Ranula is a tumor of a salivary duct, formed in consequence of obstruction. The swelling is generally situated under the tongue, in one of the submaxillary ducts, and is produced by an accumulation of thickened saliva. This affection is by no means rare, but is more commonly met with in children. Sometimes it appears a few days after birth; and in that case arises from a native imperforation of the duct. When it occurs in the adult, it is generally the consequence of adhesion; but it has often originated from a small calculous concretion stopping up the mouth of the duct. In short, any source of obstruction will produce the disease.

Ranula at its commencement is unattended with pain or inconvenience; but as it increases in size, it raises up the point of the tongue, forces it back into the mouth, impedes the breathing and swallowing, and renders the articulation very indistinct. In an early stage of the disease, the contents resemble the white of an egg, and, if the sac is thin, make the tumor pellucid and of a bluish colour; in a more advanced stage, they are of the consistence of honey, and, when the sac inflames, are frequently purulent, so that the transparency of the tumor is lost. Ranula may exist anywhere within the mouth in the situation of a salivary duct. It is most commonly placed on one side of the fraenum linguae, but sometimes the obstruction exists in both the submaxillary ducts at the same time, and then there are two distinct tumors. There is great variety in the form and size of these swellings; in general, their figure is oblong, and about the bulk of a filbert; but they sometimes attain a much larger size. Although, when greatly distended, the sac often bursts, and the contents are discharged, so as sometimes to produce a cure, more commonly the opening closes and the disease returns.

## TREATMENT OF RANULA.

PARE′ and the older surgeons employed for the cure of ranula the actual cautery. Modern surgeons open the tumor with a pair of sharp-pointed scissars or with a lancet; but the disease often returns from the reunion of the lips of the wound, sometimes indeed from the opening not being sufficiently large. In the treatment of this disease, the surgeon should lay the tumor open in its whole extent, so as to discharge its contents, and then attempt to clear the duct by means of a fine probe, and by injecting warm milk and water with a small syringe. If the tumor is large, it will be advisable to cut away a portion of the sac; indeed, where this is the case, and the sac much thickened, the whole anterior or loose portion should always be removed; otherwise, although the discharge from the duct may be rendered sufficiently free, there will still remain such a thickness of parts as greatly to impede the motions of the tongue.

The clearing of the mouth of the duct is of the first importance; for, if a small stony concretion be impacted in it, the disease will return if the incision heals. Turner * relates the case of a young woman having a ranula, which he opened with a heated pointed cautery. He believed her cured, and dismissed her; but she returned in two months,

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* See Turner's Surgery, vol. i. page 154.

with the cyst filled again, and sometimes discharging by a small orifice which had never healed. Into this opening he introduced a small pair of probe-pointed scissars, and slit up the whole length of the tumor, out of which he turned with the probe a small stone of the size and shape of a horse bean, when it immediately healed and never returned afterwards. Small stones are frequently found in the ducts; and, in one case, after incision, Wiseman took out a stone larger than a French olive.

I have frequently succeeded in the cure of ranula, by inserting into the opening a piece of sponge tent, removing it from day to day. This prevented the reunion of the incision, and, in the course of a few days, when the first inflammation was over, the tent was withdrawn, and the opening remained free; but, on some occasions, the introduction of the tent has been followed by inflammation and swelling of the corresponding maxillary gland. I therefore consider the removal of a portion of the sac the preferable mode of cure.

## SECTION III.

### DISEASES OF THE TONSILS AND UVULA.

The tonsils and uvula are subject to inflammation and its consequences; but it is only when they become permanently enlarged so as to disorder the functions, produce distress or danger, that the assistance of the surgeon is required.

## CHRONIC ENLARGEMENT OF THE TONSILS.

In consequence of repeated attacks of acute inflammation, the tonsils become permanently enlarged, and acquire a degree of fleshy firmness, by which they not only obstruct swallowing, but also render the breathing laborious, and sometimes endanger suffocation. This is particularly the case upon the slightest exposure to cold. The enlarged state of the tonsils does not always arise from acute inflammation, but is sometimes produced by a chronic action.

When the tonsils are enlarged from acute inflammation, their size may be considerably diminished, and the progress of the inflammation arrested, by the scarification of their surface; but, when the enlargement is the consequence of a slow action, the only cure consists in the removal of the enlarged portion.

## EXCISION OF ENLARGED TONSILS.

In the removal of diseased tonsils, the surgeon should keep in mind, that no more of the gland should be cut away than what projects beyond the pillars of the fauces; otherwise he is in danger of wounding the external carotid artery lying immediately behind it. The operation may be accomplished either by the ligature or the knife. The older surgeons used the actual and potential cautery; but this practice has been abandoned for upwards of a century, and the ligature and the knife are the only means now had recourse to. Mr. Cheselden was so afraid of hemorrhage that he preferred and recommended the ligature. When the base of the tumor was narrow, he simply put a ligature about it; when broad, he perforated it with a needle, having an eye in its point, and armed with a ligature; and, as we at present do with broad-based excrescences in the neighbourhood of the anus, he split the ligature, carrying one half round the upper, and the other half round the lower portion of the gland. Mr. Sharp also preferred the ligature, and this practice is followed by several surgeons of the present day. But the ligature is tedious in its action, and always produces much inflammation and pain, on some occasions extending to the salivary glands under the jaw. The knife is therefore the preferable practice, and, if the projecting part of the gland only be excised, the hemorrhage is trifling.

The patient must be placed in a chair with his head reclining on the breast of an assistant, the jaws kept extended by some firm body, such as a piece of wood passed betwixt the teeth, and the tongue held down with a paper folder or broad spatula. The surgeon then passes a tenaculum through the tumor, and pulls it gently from its bed. While held in this situation, he, with a scalpel, cuts off as much of the gland as is judged necessary. If a common scalpel is used, that part of it next the handle must be covered with lint; but a preferable instrument is a knife, like that used in lithotomy, or in the extirpation of the eye, and cutting only to a short distance from its point. The hemorrhage which succeeds the operation is only a general oozing, and is useful by lessening the inflammation; but, should it be of long continuance, it may be stopped by gargling with a decoction of oak bark, a solution of alum, or any other astringent.

## ELONGATION OF THE UVULA.

The uvula is sometimes so relaxed as to fall down upon the root of the tongue, and produce perpetual efforts to swallow; or it touches the epiglottis, so as to excite continual coughing, and sometimes even interrupt the breathing. In this case, a portion of it may be freely cut off with scissars. The hemorrhage is slight, but, if troublesome, the wound may be touched with a hair pencil dipt in a little of the muriated tincture of iron or of spirit of wine.

## SECTION IV.

### DISEASES OF THE TEETH.

The management of the teeth is now considered as a separate department of the profession, and has become so peculiarly the province of the dentist, that the diseases of this structure are seldom treated of in surgical works; but as the extraction of the teeth requires frequently to be performed by the military and naval surgeon, and the country practitioner, I shall make a few observations on the disease which most commonly calls for the extraction—on the operation itself—and on the hemorrhage which sometimes succeeds it.

### CARIES OF THE TEETH.

When any portion of the enamel is broken off, and the bony part of a tooth is exposed to the air, it soon becomes carious; but it has frequently been observed, that, in consequence of some external disease, the osseous part decays, while the enamel remains entire. There is then formed a distinct cavity, surrounded by a shell of enamel, which, in the act of chewing hard substances, often breaks and exposes the cavity. The exposure of the cavity of the tooth to the air is frequently followed by inflammation of the nerve, or of the lining membrane, giving rise to toothach. In some families, and in some particular constitutions, the teeth have a great tendency to decay. The molares are more frequently affected than any of the others, and it has been observed, that the disease occurs oftener in early than advanced life.

When toothach arises from exposure of the nerve, the pain may be mitigated, or removed for a time, by the introduction of opium, camphor, tincture of tobacco, and other narcotics; but a permanent cure can only be effected, either by closing up the cavity, by destruction of the nerve, or by the extraction of the tooth. The cavity of the tooth may be closed up by stuffing it with tinfoil or gold leaf, or it may be filled, from time to time, with gum mastich. When a metallic substance is employed, the progress of the caries is prevented or delayed, the patient is freed from toothach, and the tooth may remain serviceable for many years. When we have recourse to gum, the tooth slowly decays, without pain. For the success of this method of cure, it is necessary that the opening into the tooth should be small, otherwise the substance with which the cavity is stuffed will not remain in; and the practice should only be had recourse to when the patient is free from pain, for, if a tooth be stuffed when in an inflamed state, the pressure on the nerve will increase the inflammation, and render the pain almost insupportable.

The destruction of the nerve of a tooth may be effected either by the potential or actual cauteries. The potential cautery consists in the introduction of the argentum nitratum into the hollow of the tooth, or of a few drops of the sulphuric or muriatic acids, conveyed by means of a little cotton, or a bit of lint; but I conceive this to be one of the worst ways of removing toothach. In its application, there is danger of burning the tongue and other soft parts within the mouth. Unless extensively employed it will not be successful, while it always enlarges the cavity, by the farther destruction of the structure; besides, when it does succeed, the tooth is so much destroyed, that in a short time it either breaks across by the gum, or its connections are so injured that it becomes loose in the socket, and falls out, or requires to be removed.

If the destruction of the nerve is to be attempted, the actual is more effectual than any potential cautery; and when this mode of curing toothach is adopted, the common practice is, to pass into the cavity of the tooth a red hot wire. If the surgeon is so fortunate as to strike the nerve, he will no doubt succeed in curing the disease; but, from the irregularity of the cavity, it is sometimes difficult to hit the nerve; and, unless this is done so as completely to destroy it, the pain will not be removed. The destruction of the nerve may be more easily and more certainly attained, by heating to redness the end of a long blow-pipe, introducing it into the hole, and then blowing through the tube, by which a stream of hot air is conveyed, which instantly cauterises both the nerve and the lining membrane. The actual cautery is always attended with great pain, is often followed by violent inflammation, and is so terrific, that both practitioner and patient generally prefer the extraction of the tooth.

## EXTRACTION OF THE TEETH.

MUCH has been said about the imperfection of the dentists' instruments, and great ingenuity has been exerted to contrive one by which the perpendicular extraction of a tooth might be effected; but, independently of other considerations, the diverging direction of the fangs, and the injury which must be done to those teeth which sustain the counterpressure, will always prevent the application of this mode of extraction. It must be remembered, that the tooth-key in present use does not act entirely in a lateral direction, but combines a perpendicular with a lateral extraction; and, when the instrument is so constructed, that the bolster is placed before or behind the tooth to be extracted, as in the keys of Messrs. Spence, Fox, and Hardy, I believe the instrument to be more perfect than is generally imagined. These gentlemen seem to have effected so material an improvement, that any difficulty, which may occur in the extraction, is more to be ascribed to the want of dexterity in the operator, than to the deficiency of the instrument.

The incisores and cuspidati are easily removed by straight or curved forceps, and the bicuspides by the same instrument, or by the common tooth-key with a small claw; but the teeth most difficult to extract are the large molares, and more especially the dentes sapientiæ of the lower jaw. In the extraction of the large molares, the gum should always be well separated from the tooth, both to prevent laceration, and to admit of a more easy extraction. All the teeth of the upper jaw should be pulled outwards, because the inner fang of these teeth is the strongest, and by pulling in this direction, we extract in the line of the fang, should it diverge much from the other roots; besides, in consequence of the alveolar processes being thinner on the outer side, they will more readily yield, and, therefore, there will be less risk of breaking the tooth or injuring the jaw. When a tooth is to be extracted from the lower jaw, it may be drawn either inwards or outwards; but the dentes sapientiæ should be pulled outwards if possible. This may commonly be effected by means of Mr. Spence's key, in which the claw is placed before the bolster; but, if the extraction cannot be effected in this direction, and the surgeon is forced to pull inwards, a small claw should always be used, otherwise there will be risk of extensive and dangerous fracture of the jaw.

In the extraction of the molares, either of the keys already mentioned, and which are delineated in Plate XV. may be used. They possess a decided advantage over the common tooth-key, inasmuch as the pressure is removed altogether from the tooth to be extracted; besides, when the alveolar socket is thin, the common key presses it upon the fangs of the tooth, and wedges it in, not only antagonizing upon the tooth itself, in a great degree, the extracting power at the claw, but, from the great sensibility over the socket of an affected tooth, greatly increasing the suffering of the patient. Although either of these keys be superior to the one in common use, I conceive that Hardy's key with the double bolster is the preferable instrument, because it not only offers no resistance to the tooth to be extracted, but, as it consists of a double fulcrum, divides the pressure upon two healthy points and increases the power. The comparatively little manual force required in extraction of the molares with this instrument will best show its superiority.

Previous to the operation of extraction, the bolster of the instrument should be well covered with a piece of linen, so as to offer as little violence as possible to the soft parts. When operating on the lower jaw, the patient should be seated on a chair of an ordinary height, and the surgeon then stands before him; but in extraction from the upper jaw, the most convenient posture is to lay the patient on a sofa, with his head supported on a pillow, and reclining backwards, the operator placing himself behind the patient. The direction in which the teeth are to be drawn, and the posture of the patient, may be regulated according to the fancy of the operator; but to extract with ease and safety must depend upon the proper fixing of the instrument. And here there is an invariable rule. The claw of the instrument should always be fixed below the crown of the tooth, close upon the edge of the alveolar process; and the bolster should be placed on the opposite side, a little below the point of the claw. This direction is of the first importance; because, if the bolster and point of the claw be exactly opposite to each other, when the instrument comes to act, the extracting and resisting powers being directly opposed, the tooth will not be raised from its socket, but either it or the claw of the instrument will break. We have said that the bolster of the tooth-key should rest a little below the point of the claw; but care must be taken not to place it too low, otherwise there will be danger of tearing away a portion of the jaw.

When the key has been properly placed, the first turn of the surgeon's hand fixes the instrument, and, when this is accomplished, he should continue to turn the hand steadily and slowly, by which the tooth will be first loosened and then raised from its socket. If the force is suddenly exerted, there will be danger of either breaking the tooth or fracturing the jaw. This part of the operation should therefore be slowly performed, and the power increased in proportion as the tooth yields. When the tooth has been removed, and the mouth completely washed out, the gums should be put in contact, so as to cover the empty socket, and a small piece of cork placed above it. This cork is easily fixed by nitching it in betwixt the adjoining teeth; and, by preventing the access of the food and the air, it moderates the inflammation and lessens the danger of suppuration.

## ALVEOLAR HEMORRHAGE.

After the extraction of a tooth there is always a slight hemorrhage, which generally subsides in a few hours; but sometimes it is so profuse as to be suppressed with some difficulty, and cases are recorded where the hemorrhage even proved fatal.

When the bleeding from the socket of an extracted tooth is formidable, all astringent washes or dossils of lint dipt in turpentine or spirits of wine are quite insignificant, the potential cautery is useless, and the actual cautery may even fail, because it cannot be applied directly to the bleeding vessel; but I conceive the following method will always succeed, however profuse the hemorrhage may be. Let the surgeon take a small piece of firm dry sponge, let him force it with a probe into the bleeding socket; let him then cut a piece of cork of such a form as to nitch in betwixt the adjoining teeth, and of such a thickness as to rise a little above their level; let him place this above the sponge, then bring the jaws of the patient together, and secure them in that situation by the four-headed roller used in fractures of the lower jaw. By this means such a pressure will be kept up as will most effectually stop any hemorrhage. In one case to which I was called, where the patient had lost a great quantity of blood, and where every means, except the actual cautery, had been tried in vain to stop the bleeding, the method which I have now recommended succeeded at once; and on every occasion where I have directed the same practice to be employed, it has proved successful.

# CHAPTER XVIII.

## ACCIDENTS AND DISEASES OF THE THROAT.

### GENERAL REMARKS ON THE STRUCTURE OF THE THROAT.

To acquire right conceptions of the accidents and diseases of the throat, the young surgeon should not only recall to his recollection the descriptive anatomy, with which it is presumed he is well acquainted, but consider the relative connexion and correspondence of the pharynx and larynx in the act of swallowing, as the least derangement in this process endangers suffocation. The pharynx is a muscular bag, capable of great dilatation and contraction. It arises from the basis of the skull, is somewhat of a funnel shape, and terminates in the œsophagus, the commencement of which is situated immediately behind the lower part of the cricoid cartilage, and is the smallest part of the tube. While the pharynx changes its form, and alters its capacity according to the size of the morsel it embraces, the larynx, from being composed of rigid cartilages, remains always open, although the chink of the glottis is increased or diminished, according to the action of the delicate muscles which move the arytenoid cartilages. The larynx is shorter than the pharynx. It is situated in the upper part of the throat. It commences at the top of the thyroid cartilage, and terminates at the lower part of the cricoid, where the trachea begins. The corresponding parts of the two tubes are the larynx and the pharynx, and the trachea and œsophagus.

In the act of swallowing, the whole throat rises by the power of those muscles which are attached to the larynx. This action can be distinctly perceived by placing the finger upon the thyroid cartilage, and swallowing the spittle. When we swallow, the pharynx is raised and widened to receive the morsel, which is forced into it by the tongue. As soon as the morsel has entered the bag, it is firmly grasped and pushed along by the contraction of the muscles. This contraction of the pharynx is so instinctive and violent, that although we are conscious that there is a bone or a pin in it, we cannot stop till we have swallowed it. It is erroneous to suppose that the food falls into the stomach by its own weight; it is urged along by muscular contraction; and, when the muscles performing this function become paralytic, the power of swallowing is lost.

While the morsel is passing from the mouth into the œsophagus, it first presses back the velum pendulum palati, so as to cover the posterior nares, and perform the office of a valve. It then lays down the epiglottis, so as to cover the entrance into the larynx; and at the moment that the epiglottis is thus laid down, the larynx is strongly pulled up to it by the action of the muscles, by which the opening into the tube is so accurately shut, that we cannot eat and breathe at the same time. From all these securities, we should naturally suppose that foreign bodies could hardly get admittance into the larynx or trachea; neither can they, while this consentaneous action betwixt the pharynx and larynx in the act of swallowing remains; but it is destroyed by attempting to speak or breathe while we are swallowing, by a paralytic state of the muscles performing this function, by wounds in the upper part of the throat, and by many other causes.

## FOREIGN BODIES IN THE PHARYNX AND ŒSOPHAGUS.

A variety of extraneous substances are frequently detained in the pharynx or the œsophagus, in the act of swallowing, such as pins, needles, bones, pieces of flesh or gristle, crusts of bread, coins, &c. These are sometimes productive of alarming consequences, from the immediate effect which they have upon the breathing, from the inflammation which they are apt to induce, from the danger of their passing into the stomach, and from various other circumstances. Sharp-pointed bodies, as needles, pins, or fish bones, most frequently stick in the pharynx, while crusts of bread, pieces of cheese, or gristles, are commonly detained at the commencement of the œsophagus; but if the extraneous substance is large, it is apt to be caught in the pharynx, and is then productive of instant suffocation. Amongst the variety of substances which stick in the gullet, some are harmless when received into the stomach, being either capable of digestion, or passing unchanged through the alimentary canal, and evacuated by stool; others are of a dangerous nature from their pointed form, and from their bulk; and although many cases are recorded, where needles, pins, nails, prongs of forks, buckles, and pieces of wood, have passed safely through, and been discharged by stool, after a longer or shorter time, still no person can be accounted safe when such substances have been received into the stomach.

A foreign body engaged in the gullet may induce death in a variety of ways. When it sticks in the pharynx it may produce suffocation, by exciting spasm in the glottis; when it stops in the œsophagus, it may lead to the same fatal termination, by pressure on the trachea; the former is sudden, while the latter is generally slow in its action. Inflammation, suppuration, and even gangrene, are also not unfrequent consequences of extraneous substances sticking in the œsophagus.

It sometimes happens that a sharp-pointed bone, or a pin, sticks in the throat; in the course of forty-eight hours the throat inflames and swells, and the swallowing and breathing become very difficult, attended with considerable fever; the inflammation at last terminates in gangrene, but more commonly suppuration follows. The foreign body then becomes loose, and is either brought up by the mouth, or falls into the stomach, or works its way through the walls of the tube, when it produces abscess in the neck, and is discharged outwardly. Sharp-pointed bodies are more apt to excite inflammation than those substances which are of a flattened or rounded form; but the œsophagus may inflame, and the patient die, from the continuance of a gristle or piece of flesh so small that it can be easily pushed into the stomach. Some years ago I was called, on a Tuesday morning, to an old man, who, in eating beef the Sunday evening before, swallowed a gristle, which stuck in the upper part of the œsophagus. When I saw him, his breathing was difficult, and his pulse quick. I made him attempt to swallow a little cold water, but none went down; I immediately pushed down the gristle into the stomach by means of the probang, and with no difficulty; but he died next morning, although the extraneous substance had not been in the gullet above thirty-eight hours.

When a pin or a needle falls into the stomach, it sometimes passes through the pylorus, but sticks in the intestines, exciting inflammation and suppuration, which terminates in abscess, and the pin or needle is discharged externally; but sometimes it induces general convulsions and death. I have often seen pins, which had been swallowed, passed safely by the anus; but there is great danger of such pointed bodies sticking in some part of the alimentary canal, and producing a variety of alarming symptoms. Mr. M. had a child, who, when three months old, was attacked without any apparent cause with convulsions. He had little rest night or day, and was so ill, that every hour he had a fit more or less severe. The most eminent of the faculty in this city were called in; some ascribed it to teething, others to the bowels, but the general opinion was, that it arose from an affection of the head. The warm bath was in continual readiness to plunge him in when attacked; the head was repeatedly blistered, and many remedies were tried, but without any diminution of the severity or frequency of the convulsions. At the end of three months, that is, when the child was six months old, the fits became much less frequent, and in four months more, they entirely ceased. One night, while the child was undressed, and sitting on his father's knee, a hard and pointed body was felt under the skin, over the region of the stomach. Upon examination, his father perceived it blue under the skin, and saw clearly that it was either a needle or a pin. The child was now twelve months old, and, as he had no particular complaint, and was extremely weak, the medical attendants were not very solicitous to cut it out. In a short time the child became strong and healthy, and the circumstance was forgot. It, therefore, was not cut out till he was sixteen years of age. It was then situated over the cartilages of the three uppermost false ribs, on the right side, where they join the sternum, and was so entangled with the fascia and condensed cellular substance, that, in pulling it out with the forceps, it broke.

The most natural conjecture concerning this case is, that, when the child was three months old, it must have swallowed the pin; perhaps a pin had fallen out of the nurse's handkerchief or shawl when she was applying the child to the breast, and it had dropped unperceived into his mouth, and been swallowed; the convulsions must have arisen from its sticking in the œsophagus, or the stomach; and when it had worked its way through the stomach, peritoneum, and muscles, the convulsions ceased. The pin had remained nearly sixteen years in the body, and was quite black when extracted.

There are several cases on record, where sharp-pointed bodies, after being swallowed, instead of being evacuated by stool, have passed from the intestines into the bladder, and been discharged by the urethra; and, on some occasions, sharp-pointed substances stick in the rectum, immediately within the anus, and produce inflammation and abscess. This occurrence is frequently the cause of fistula in ano.

## REMOVAL OF FOREIGN BODIES FROM THE PHARYNX AND ŒSOPHAGUS.

A VARIETY of instruments have been contrived for the removal of foreign bodies from the gullet, but the most useful are curved forceps of various sizes, and the probang. The probang is a whalebone rod, with a piece of sponge at one end, to push the extraneous substance down into the stomach. It should have a blunt hook at the other to catch pins, needles, and other substances, which it might be dangerous to push down. The sponge should also have a narrow tape attached to it, both to prevent the possibility of its slipping off, and because, in our attempts to push substances down, it sometimes happens that the body sticks fast, and the sponge passes it; and when there is a tape attached, there is a greater chance of our engaging the substance as we withdraw the probang.

Previous to the use of the probang, the surgeon should examine the throat, for if the foreign body is pointed, as a pin or a fish bone, it will most commonly be found sticking in the isthmus faucium, or upper part of the pharynx, when it may be easily removed by a pair of curved forceps, or the hook of the probang. If the extraneous substance is large, filling the pharynx, it may frequently be dislodged by pressing forcibly with the thumbs upon the sides of the thyroid cartilage, at the same time striking the patient betwixt the shoulders. If the substance has got engaged in the œsophagus, the surgeon must either, according to its nature, attempt to push it down, or extract it with the probang; and, in using this instrument, the head of the patient should be reclined backwards and his tongue retracted, while the surgeon pushes the instrument against the back part of the pharynx, when the firmness of the vertebræ will direct it downwards into the gullet.

In laying down rules of practice, we may arrange foreign substances, sticking in the œsophagus, under three classes.—1st, Those substances which are digestible in the stomach, and therefore may be safely pushed down, such as crusts of bread and pieces of flesh or gristle. These bodies cause death either by producing suffocation, or by exciting inflammation and gangrene in the tube, and should be instantly dislodged by pushing them down with the probang.—2d, The second class embraces those substances which are not digestible in the stomach, such as coins or the stones of large fruit. Although these substances are frequently passed by stool, they are not quite safe in the alimentary canal; the surgeon should therefore endeavour to extract, but if he cannot effect this, instead of persisting in fruitless efforts, which are apt to produce inflammation of the œsophagus, he should force these substances down into the stomach.—3d, The third class includes those bodies which are highly dangerous when they pass into the stomach or intestines, as needles, pins, or fish-hooks. In this case, we should always endeavour to extract. When this is impracticable, rather than push them down, I apprehend that the best practice is to allow them to remain, as there is then a chance of their being loosened by suppuration, and coughed up or removed by other means.

It is sometimes impossible either to extract bodies sticking in the œsophagus, or to push them down into the stomach. In such cases some practitioners have recommended to provoke vomiting, by irritating the throat with a feather, by swallowing an emetic solution, or by throwing up an enema of an infusion of tobacco; but this practice is very dangerous, and should not be generally followed, as there is a risk of bursting the œsophagus.

When the foreign body is engaged in the lower part of the pharynx, or commencement of the œsophagus, endangering suffocation, and it is found impossible either to extract it or to push it down, it may be removed by cutting into the tube, which operation is called œsophagotomy, or pharyngotomy. This operation may also be required when the extraneous substance is of that nature, that it would be dangerous when lodged in the stomach.

along the groove, the pharynx is to be opened, and the foreign body removed by the introduction of curved forceps. After this, the edges of the wound are to be brought together and secured by adhesive plaster and the uniting bandage. Neither food nor drink should be swallowed for a few days, but the patient's system must be supported by nourishing soups thrown into the rectum.

In performing this operation, the course of the incision should be kept clear by the repeated use of the sponge, and any blood vessel that may be divided should be immediately secured.

## FOREIGN BODIES IN THE TRACHEA.

Bodies of great magnitude, larger than one should imagine, are frequently found to enter the trachea, such as cherry-stones, beans, plumb-stones, and almonds.

When a foreign body first enters the windpipe, it excites violent convulsive cough; the face becomes flushed, the eyes protrude, and the patient is in danger of instant suffocation. This occurs while the substance is in the glottis; but, in general, it immediately descends into the trachea, or passes into one of the ventricles of the larynx, when the patient feels great relief, and is freed from immediate danger. When the substance is detained in the glottis, suffocation soon follows; but when it descends into the trachea, it may not produce death for several days; indeed, the effects are various according to the situation of the foreign body. The larynx is much more irritable than the trachea; and when any extraneous substance approaches the glottis, it excites spasm, and suffocating cough immediately follows. When the foreign body passes into the trachea, the danger is less; there is difficult respiration, wheezing, rattling in the throat, and a hoarse voice; and death does not occur for the space of two or three days, although the patient may be suffocated in a moment, if the foreign body should approach the glottis. When the extraneous substance descends so low as to pass into one of the branches of the trachea, it produces, comparatively speaking, little uneasiness; and when it passes still lower, into the bronchia, it sometimes remains for months, or even for years, and is at last coughed up after having produced abscess of the lungs; but, on other occasions, this suppuration terminates in fatal hectic fever. There is a case related by Vander Wiel,* of a young woman, who, in eating soup, swallowed a portion of bone, which entered the trachea; it passed down to the lungs, and produced both bloody and purulent expectoration, but was coughed up at the end of four months. There is also a famous case by Mr. Louis, detailed in the Memoirs of the Royal Academy of Surgery, where, so large a coin as a louis d'or entered the glottis, descended through the trachea, and remained five years, producing suppuration of the lungs and fatal consumption. In the same Memoirs is the case of a young girl, into whose trachea a portion of the rump bone of a pigeon had passed, and which, after remaining seventeen years, was at last rejected in a violent fit of coughing.*

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* Vander Wiel, Cent. I. Observ. 23.

The marks which indicate that a foreign body has passed into the trachea, and is not engaged in the œsophagus, are a troublesome and convulsive cough, a hoarse voice, a continual tickling, and difficult respiration, with wheezing; the patient, at the same time, swallows with freedom, and he has such a distinct perception of the situation of the extraneous substance, that he can point it out to the surgeon. When the difficulty of respiration is considerable, and has been of long continuance; it is followed by emphysema of the neck and top of the chest, which arises either from the separation of the rings of the trachea, or more probably from the bursting of some of the air cells in the lungs, and the escape of the air into their cellular substance, from which it passes into the cellular substance under the sternum, and at last appears in the neck.

The presence of foreign substances in the air-tube is attended with the most imminent danger.

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* Mémoires de l'Académie Royale de Chirurgie, tome 14. 12mo. edition.

When caught in the glottis, they produce death by the spasm which they instantly excite; in the trachea they kill by inflammation or by effusion into the air cells of the lungs, induced by the laborious action; and in the lungs, they destroy by suppuration and hectic fever. When they descend below the larynx, the danger is not so immediate; but the foreign body is apt to be brought up to the glottis by a change of posture in the body, by coughing, or by driving the air forcibly out of the tube, as in wheezing; and, when this is the case, the patient is instantly suffocated. Whenever, therefore, a patient presents himself with a foreign body in the wind-pipe, and that substance is of such a size as to afford little chance of its being expelled, an opening should be immediately made in the trachea for its removal. The operation is neither difficult nor dangerous; but, previous to bronchotomy being resorted to, in any case, on account of the presence of a foreign body, a probang should be passed into the œsophagus, as there is a possibility of the foreign body being in that tube, and producing the dangerous symptoms by exciting spasm of the glottis.

## BRONCHOTOMY.

Bronchotomy is an operation which consists in making an opening into the wind-pipe, with a view to inflate the lungs in suspended respiration, to remove foreign bodies which may be present in that tube, or to admit the air in those cases where there is an obstruction to the breathing. Although this operation appears alarming, it is in itself void of danger. Wounds of the trachea heal very readily, and, from the facts collected by Louis* from the result of Pelletan's cases,† as well as those recorded in the Transactions of Chirurgical Societies, and the periodical publications of the day, it appears that bronchotomy is not only a safe but a frequently-called-for operation.

One of our motives for performing bronchotomy was stated to be inflation of the lungs, in suspended respiration; but there is no absolute necessity for having recourse to this operation, to enable us to inflate the lungs. Baudelocque, Pelletan, and Desault, introduced, in such cases, a catheter of elastic gum, and this seems in general to be the preferable practice. If the patient's head is kept upright, and the tongue brought forwards out of the mouth, there is no difficulty in passing an elastic gum catheter along the nostril and carrying it into the larynx. As soon as the instrument appears behind the velum, the surgeon should lay hold of it with a pair of dressing forceps from the mouth, and, carrying it directly downwards, he will pass it at once into the larynx. From the state of the patient, there is neither struggling nor spasm of the glottis to retard the introduction; and, when once the tube is introduced, the lungs may be readily inflated by means of a pair of common bellows. The introduction of a tube through the nostril prevents the necessity of having recourse to bronchotomy, in those cases where we wish to inflate the lungs; but, when such a tube is not at hand, as the call is urgent and delay is dangerous, the surgeon should at once make an opening into the wind-pipe.

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* See Mémoires de l'Académie Royale de Chirurgie.

† Clinique Chirurgicale, tome i.

Although bronchotomy be in general recommended by surgical writers, as the means of inflating the lungs in suspended respiration, our chief reasons, for performing this operation, are the removal of foreign bodies, and that we may admit a free passage to the air when there is an impediment to the breathing. The first of these cases calls more imperiously for the operation than the second, and the earlier it is performed the better; for, when a foreign body has entered the trachea, and is of such consistence that it cannot be dissolved, the patient is in the most alarming danger; as the substance is at all times liable to come in contact with the glottis, when he may be suffocated in a moment. If it remains long in the trachea, independently of any mechanical obstruction to the breathing it excites inflammation, which is followed by an effusion into the cells of the lungs; or, even if the foreign body be removed, it may have previously excited such an action as will terminate in phthisis pulmonalis. When, therefore, a surgeon is called to a patient in whom a foreign body has passed into the wind-pipe, and this is of such a size and consistence that there is no chance of its being coughed up or dissolved, the rule of practice, obviously, is immediately to perform bronchotomy.

Another reason, which we enumerated as calling for the operation of bronchotomy, was to admit air in those cases where there was an obstruction to the breathing. Obstruction to the breathing may be induced by a multiplicity of causes, but most frequently arises from tumors, from ulceration of the glottis, and from chronic or acute inflammation. When the breathing is much obstructed by the existence of a tumor, whether it be situated in the fauces, preventing the free passage of the air into the larynx, on the fore part of the neck, or in the œsophagus, causing pressure on the tube,—as the laborious respiration, induced by this pressure, not only produces suffocation, but is apt to terminate in effusion into the cells of the lungs, bronchotomy should be performed.

Ulceration of the glottis is most commonly induced by the venereal or mercurial disease, although it may arise from other causes. When it occurs, it is attended with cough, perpetual irritation, and spasm, which, if the action be long continued, uniformly terminates in effusion. This state of the glottis, therefore, calls for an artificial opening into the wind-pipe, which requires to be maintained till the ulceration is cured.

The two last causes of obstructed breathing which we have named, and which most frequently occur, are chronic and acute inflammation.

In the former of these, there is so much thickening in the glottis that there is formed a mechanical obstruction to the breathing, and this, as in the other cases, is followed by effusion. The parts may have assumed a granular and fleshy appearance, but the most common form of the disease is that which has been termed Œdema of the glottis, or the Angina Laryngea Œdematosa of M. Bayle. In this case, the rima glottidis is much diminished in size, in consequence of serous effusion into the cellular substance under its mucous membrane. This state of the larynx is attended neither with fever nor pain on pressure, and the inspiration is difficult, while the expiration is easy.

In acute inflammation of the larynx or trachea, such as in laryngitis and croup, surgical writers are divided in opinion with regard to the operation of bronchotomy. Some patients have recovered after the operation, but more have died. It appears to me, that in the commencement of the disease no practitioner would think of the operation. When it has made some progress, the inflammation is rarely confined to that part which was first attacked, and, if an incision be made into the wind-pipe when in an inflamed state, the danger, instead of being lessened, will be increased. We cannot doubt of this when we see patients dying of inflammation following simple wounds of the trachea. Again, when the difficulty of respiration becomes urgent, and the violence of the inflammation has subsided, it is too late to operate, as effusion has by this time taken place into the bronchia. I do not deny that patients may recover after bronchotomy has been performed in acute inflammation of the trachea. I only contend, that the operation is more suited to the chronic form of the disease, and, when the inflammation is acute, the treatment should consist chiefly in large general and local bleedings, early performed, large blisters applied to the chest, large doses of calomel and antimony, with the warm bath; and, when the violence of the inflammation is over, if it should appear that any existing difficulty of respiration depends on thickening or spasm of the glottis, and not on effusion into the bronchia, bronchotomy, no doubt, should be performed.

The wind-pipe may be opened either in the larynx or the trachea; the former of these operations is termed laryngotomy, and the latter tracheotomy. The incision must be kept in the median line, and, whichever of the operations is performed, the first object of attention is, to secure every bleeding vessel, whether artery or vein, and not to open the tube till the hemorrhage has nearly or entirely ceased, otherwise, the blood, entering the trachea, will endanger suffocation. The second object which claims attention is the size of the opening, and this should always be very free, as a small opening does not allow a foreign body to be easily removed;

and, when bronchotomy has been performed, to obviate suffocation, a small opening so soon fills up with mucus, that no relief is obtained from the operation.

## LARYNGOTOMY.

LARYNGOTOMY consists in making an opening into the wind-pipe, in the membranous space betwixt the thyroid and cricoid cartilages. This method of operating was first proposed by Vicq. D'Azyr, and is the operation which is preferred to tracheotomy, by the French surgeons. From the larynx being more thinly covered than the trachea, from its being more easily fixed, and from the small size of both arteries and veins, it is not only more easily performed than tracheotomy, but is more speedily executed; as the surgeon is not so apt to be embarrassed by any bleeding, which may, for a while, prevent him from opening the tube. It is also the operation which is best adapted for the removal of foreign bodies, because, if these bodies are engaged in the larynx, which is frequently the case, either the opening is made directly upon them, or they can be easily removed by slitting up a part of the thyroid cartilage; and again, when the extraneous substance is in the trachea, if the opening is sufficiently large, it will be thrown out in coughing, or in a strong expiration. In short, in all cases where bronchotomy is called for, laryngotomy is preferable to tracheotomy, except where the larynx is much inflamed, or where the seat of obstruction to the breathing is below the crico-thyroid membrane.

In performing laryngotomy, the patient should be laid on a table or a couch, with his head reclining backwards; the surgeon then places himself at his right side, and, after having determined on the space betwixt the thyroid and cricoid cartilages, he stretches the integuments and fixes the larynx, by pressing with his fore finger upon the former, and with his thumb upon the latter of these cartilages. He now makes an incision about an inch in length, in the median line, beginning about the middle of the thyroid, and terminating at the lower part of the cricoid cartilage; and, by repeating the incision in the same track he passes through the platysma-myoides, and betwixt the sterno-hyoidei, and sterno-thyroidei muscles, which he separates with the handle of his knife, till he exposes the crico-thyroid membrane, when he pushes the point of his scalpel in a transverse direction through it. Sometimes a small branch of the superior thyroideal artery, which traverses the lower edge of the thyroid cartilage, is cut; when this is the case, it should be secured by ligature; and, before the internal opening is made, all bleeding should be suppressed by bathing the parts with a little cold water and vinegar. When the surgeon is operating for the removal of a foreign body, if it should be engaged in the sacculus laryngis, it may be necessary to slit up the thyroid cartilage; and, when it is in the trachea, and the opening which has been made is not sufficiently large to permit the extraction of it, the incision should be continued down through the cricoid cartilage. As soon as the foreign body has been removed, the edges of the wound should be brought together, and the treatment conducted upon the principles of common incised wounds. But when the operation has been performed to admit of free breathing, the opening must be maintained till the obstruction to the respiration is removed. In this case, instead of introducing a tube, which is frequently productive of great irritation, it is preferable to cut out a portion of the cricoid cartilage, as practised by Mr. Lawrence, or to insert betwixt the cartilages the points of a pair of small stiff dissecting forceps. Either of these methods will keep the opening free.

## TRACHEOTOMY.

The trachea, when compared with the larynx, is proportionally longer in the child, than in the adult; hence there is more room to cut into it in infancy than in the grown up person. But from its deep situation, from its being less easily fixed, particularly in a state of high breathing, from the upper part of it being covered to a greater or less extent by the isthmus of the thyroid gland, from the thyroideal veins situated on its fore-part, and from an artery sometimes arising from the arteria innominata, and running up on its anterior surface,* it is both more difficult and more dangerous to cut into the trachea than the larynx.

When tracheotomy is to be performed, the patient and surgeon are to be placed in the same position as in laryngotomy. The surgeon then commences his incision a little below the cricoid cartilage, and carries it in the middle line, directly downwards till near the top of the sternum. This incision should pass only through the skin and platysma myoides, and, after these parts are fairly divided, the surgeon should, either with his finger or the handle of his scalpel, separate the sterno-hyodei and sterno-thyroidei muscles, which must be held aside by an assistant, so as to expose the trachea. By not employing the cutting edge of his knife in this part of the operation, he will run no risk of dividing the isthmus of the thyroid gland, which sometimes bleeds profusely, the thyroid gland itself, which in some subjects nearly covers the trachea, or any large artery.† When the thyroideal veins, which are situated below the isthmus of the gland on the fore part of the trachea, come into view, they should be held asunder before the wind-pipe is opened; or, if cut, they should be immediately secured by ligature. When the trachea has been exposed, it should be opened by a longitudinal incision carried through two of its rings, which may be enlarged, if necessary, by carrying the knife directly upwards, towards the cricoid cartilage. The opening must be kept free, by cutting out a longitudinal slip of the cartilage, or, by what is perhaps preferable, the introduction of the points of the dissecting forceps, as recommended in laryngotomy.

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* I have an adult preparation in my possession, where this artery is as large as a crow quill.

† See Barclay on the Arteries, and Allan Burns on the Surgical Anatomy of the Head and Neck, for varieties of distribution in the large vessels coming out of the chest.

# CHAPTER XIX.

## DISEASES OF THE THORAX AND MAMMA.

### GENERAL REMARKS ON THE STRUCTURE OF THE THORAX.

The physician has a deeper interest in acquiring a knowledge of the anatomical structure of the contents of the thorax, and the other great cavities, than that of the surgeon, because the greater number of the diseases of the organs which are contained in them belong to his department of the profession. But, to enable the surgeon to operate with safety and success, it is necessary that he should be acquainted with the relative situations and connexions of the contained viscera, the precise boundaries of the cavities themselves, and the nature and inflections of the lining membranes.

The surgeon may be called upon to make an opening into the chest to evacuate blood, pus, or water, or to remove a foreign body. The chief points therefore which he has to carry in his mind are, 1st, The precise situation of the diaphragm or septum, betwixt the thorax and the abdomen;

2d, The manner in which the pleura lines the chest, covers the lungs, and divides the cavity; and, 3dly, The relation that the lungs, heart, and inner surface bear to each other. This knowledge will not only fit him for operation, but will be of the first importance, when he calculates upon the course of a ball, or guesses at the direction of an incised wound.

1st, The diaphragm has its origin from the borders of the whole chest, from the ensiform cartilage, round to the lumbar vertebræ; but its centre or greatest convexity, which is attached to the mediastinum, rises in the thorax as high as the level of the fourth rib. The diaphragm forms a muscular partition betwixt the thorax and abdomen, which, when the muscle is not in action, is convex towards the former, and concave towards the latter cavity; but in inspiration it descends, and, when the breath is fully drawn comes nearly to a plain surface. From the sloping direction of the borders of the thorax, the diaphragm has an oblique position, by which the cavity of the chest is rendered much deeper behind than at the forepart.

The diaphragm is the chief muscle of respiration, and, if oppressed by fluid, whether in the thorax or the abdomen, by an enlarged liver or spleen, or even by a distended stomach, becomes impeded in its action, when there is difficult respiration. If the pressure is from the abdomen, the expiration is easy, and the inspiration laborious;

but, if the fluid is in the chest, the inspiration is easy, and the expiration difficult.

2d, To enable the surgeon to have correct notions of the situation of the lungs, and their position with regard to the ribs, when fluid is contained in the thorax, he must attend to the manner in which the pleura lines the cavity, and in which this membrane covers its viscera. The pleura is a serous membrane, and, when the thorax is opened, will be seen of a glistening appearance, lining the ribs from the sternum to the spine. If the lungs be pulled up, it can be traced onwards to the spine, from which it will be perceived to turn off and cover the convex surface of the lungs. After passing on to their edges, it enters their clefts, and runs along their concave surface till it arrives at their root, at which point it is again reflected off, and passes up to the sternum, where it joins the portion of the membrane lining the ribs. Independently of the ribs being lined and the lungs covered by the pleura, the same membrane gives a covering both to the diaphragm and the pericardium; and, from its being reflected from the root of both lobes of the lungs, it passes up to the sternum, as a double membrane, called the mediastinum, which divides the chest into two cavities, containing in its duplicature the heart in its pericardium. That portion of the pleura which lines the ribs is called the pleura costalis, and that part of the membrane which covers the lungs the pleura pulmonalis. From the manner in which the pleura lines the chest, we perceive that it not only divides it into two cavities, but that, when a fluid is collected in either of these cavities, it is contained in a distinct sac; and, in proportion as the fluid accumulates, the lungs will be compressed and removed from the ribs, the diaphragm will be impeded in its action, and the mediastinum so pressed on as to diminish the size of the opposite cavity, and prevent the free expansion of the lung of that side.

3d, In attending to the anatomy of the chest, the third point of importance, which the surgeon has to recollect, is the relation that the lungs, heart, and inner surface bear to each other; and here it must be remembered, that, strictly speaking, there is no cavity, for, in all the states of breathing, in expiration as well as in inspiration, the lungs and the ribs are always in close contact. This is so much the case, that they frequently adhere without being productive of any distress. It must also be recollected, that the air cells of the lungs in one side of the chest have no communication with those of the opposite side, and that they are supplied by distinct branches of the trachea; so that the function of one lung may be suspended, without disturbing that of the other. Nevertheless, suffocation sometimes follows the bursting of a blood-vessel or abscess in the lungs; but this is the consequence of the blood or matter rushing up the trachea, and passing into the branch which supplies the opposite lung.

The heart in its pericardium is in close contact with the lungs and with the diaphragm, and, although it be contained in the duplicature of the mediastinum, is situated on the left side of the median line, and is placed obliquely in the chest, with its base pointing to the right side, its apex to the left, and its flat surface resting on the diaphragm.

This short preliminary sketch of the surgical anatomy of the chest will be of use to the surgeon, in reflecting on the course of wounds, and in evacuating fluid.

This chapter also embraces the diseases of the mamma, and its extirpation, but it does not seem necessary to make any remarks on the structure of a gland which has nothing difficult in its surgical anatomy.

## SECTION I.

### INTERNAL DISEASES OF THE CHEST.

The internal diseases of the chest, as far as they belong to the province of the surgeon, have a reference to an operation rather than to treatment; and that operation, whether employed for the evacuation of blood, water, or pus, is essentially the same. The existence of one or other of these fluids in the chest not only causes difficult respiration, but also induces a diseased action, so that it is often necessary to make an opening for their removal.

## BLOODY EXTRAVASATION IN THE CHEST, EMPYEMA, AND HYDROTHORAX.

When fluid prevails to any extent in either of the cavities of the chest, there is difficulty of breathing, a frequent tickling cough, an inability to lie on the sound side, a weight upon the diaphragm, which induces the patient to bend himself forwards; and, when laid in the horizontal posture, and the body moved from side to side, he will feel an undulatory motion, the noise of which will be perceptible even to the bystanders. These symptoms, especially the inability to lie on the sound side, and the undulation of the fluid, are commonly more perceptible in hydrothorax, than either in empyema or extravasation of blood, because, in the first of these cases, the fluid exists in a greater quantity.

All the symptoms which we have enumerated may be produced by the presence of blood, pus, or water; but there are certain marks which point out to the surgeon the peculiar nature of the fluid. When blood is extravasated into either of the sides of the chest, the extravasation generally occurs in consequence of a wound; and, in addition to the symptoms which have just been mentioned, as characteristic of fluid in the chest, it is asserted by Valentin and Larrey, that the presence of blood is always attended by an ecchymosis, with œdema situated behind the hypochondriac region of the affected side. I believe this remark to be in general well founded, although I had once under my charge a case, where blood was extravasated in the left side of the chest, to the extent of nearly four pounds, and the patient lived eleven days after receiving the wound; but there was no ecchymosis, nor any other external mark, by which the presence of effused blood could be ascertained.

When pus is contained in any of the cavities of the chest, there are, along with the other marks of the presence of a fluid, several attending circumstances which may guide the judgment of the practitioner. The affection is always preceded by symptoms of inflammation; at the time of the formation of the pus it will be found that there were frequent and long continued rigours; and if it has existed for some time, the affected side will be more prominent than the other, and the integuments œdematous. When the accumulated fluid is water, both sides of the chest are generally affected at the same time; whereas, in empyema the pus is most commonly confined to one side. The hydrothorax is also often accompanied by swelling of the legs, paucity of urine, irregularity of the pulse, and other constitutional symptoms of dropsy; and, as we have already observed, the undulation of a fluid, upon motion or percussion, is more distinct than either in effusion of blood or empyema.

## PARACENTESIS THORACIS.

An opening may be made into the chest, for the evacuation of any of the fluids which we have mentioned; but the operation is better adapted for the removal of blood or pus than of water. Indeed, I do not conceive hydrothorax to be a fit case for operation, except it clearly appears that the disease does not depend upon any organic affection. Although there are many cases on record, where large quantities of water have been discharged by making an opening into the chest, and the patients have recovered, yet in all those in which I have been concerned, either the fluid collected again immediately, or the chest was attacked with inflammation, and the patient died; whereas in empyema, the inflammatory action is terminated in the formation of pus, and as, after operation, it is in general reproduced, the patient has not a great chance of recovery.

In performing paracentesis thoracis, the patient should be raised in bed with pillows, and so placed that his head and shoulders may recline backwards. The surgeon then feels for the seventh rib, counting from above downwards. When he has discovered the rib, he should gently pull the integuments upwards with the fingers of his left hand, while, with the scalpel in his right, he makes an incision directly on the rib, half way betwixt the spine and the sternum, carrying it down till it touches the bone. * This incision should be about two inches in length; and, after it is completed, the surgeon should pull the integuments still farther upwards, so as to enable him to make his second incision through the intercostal muscles, close upon the upper edge of the seventh rib, by which there will be no danger of wounding the intercostal artery. The second incision should be about an inch in length, and formed by successive strokes of the scalpel, till the pleura is exposed in the centre of the incision, when it should be cautiously opened by the point of the knife. As soon as an opening is made into the chest, the integuments should be allowed to fall down, so as to cover the wound and exclude the air. The fluid may be readily evacuated, by passing under the flap a female catheter, or a curved director; and, to enable the surgeon to empty the chest more completely, the patient should be inclined towards his face, by which the fluid may be more effectually discharged. If there is much fluid in the chest, the

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* The French surgeons, in the evacuation of pus and other fluids from the chest, make an opening at a lower point than the English surgeons. Boyer directs the paracentesis to be performed betwixt the fourth and fifth false ribs, on the right side; and between the third and fourth, when operating on the left side, counting from below. *Traité des Maladies Chirurgicales*, tom. vii. par M. le Baron Boyer.

whole should not be evacuated at once, because the accustomed pressure would be too suddenly removed from the heart and great vessels. In this case, part of the fluid only should be taken off. The integuments should then be secured over the wound, by adhesive plaster, compress, and roller. The remaining portion of fluid may be evacuated next day, by undoing the bandage, and again introducing under the integuments the director, or female catheter.

When the fluid is either blood or water, as soon as the whole is evacuated the wound should be closed with a view to adhesion; but if the disease be empyema, it will be necessary to introduce into the opening a small bit of oiled lint or linen, leaving a sufficient length hanging out to prevent any risk of its slipping into the thorax. This tent should be removed evening and morning, to permit the free discharge of the matter; and, when the secretion ceases, it should be entirely withdrawn, and the wound allowed to heal.

## SECTION II.

### DISEASES OF THE MAMMA.

The female breast is subject to a multiplicity of diseases. Some of these require extirpation, either from their malignant nature, or from the inconvenience which they occasion; while others are curable by more gentle means. The diseases which most commonly attack the breast, are abscess, scrophulous enlargement, sarcoma, scirrhus, and cancer; and, if we except the uterus, the eye, and the testicle, there is no part of the human structure more prone to disease. In tracing organic diseases, we perceive that those organs whose actions are irregular are most ready to fall into disease; as examples, we may name the mamma, uterus, and testicle. The functions of these organs do not, like those of the liver or kidneys, commence with the existence of the animal; and they are destined to terminate long before its decease. They are also irregular in their actions, being more excited at one time than another.

## MAMMARY ABSCESS.

Abscess of the mamma is more apt to attack women in the early months of suckling, than when the gland has for a long time secreted milk; but this affection is not necessarily confined to women who are suckling. It sometimes occurs in young girls of fifteen or sixteen years of age; and, when unconnected with the childbed state, is more peculiar to early life than to the advanced stage. Sometimes the gland is only partially inflamed; but, at other times, the whole glandular structure of the breast is involved in the inflammation, and the irritation not unfrequently extends to the axillary glands. Inflammation of the breast is always accompanied with symptomatic inflammatory fever, which is more or less severe according to the extent of the local disease. The febrile symptoms, like those which accompany every other local inflammation, subside in proportion as the suppuration becomes established; but they are generally of long continuance, as glandular structure suppurates but slowly. In nine cases out of ten, mammary abscess arises from frights, agitation of mind, or exposure to cold, and not from external injury.

## TREATMENT OF MAMMARY ABSCESS.

In the early stage of inflamed breast, resolution may be attempted by means of free leeching and purging, combined with the antiphlogistic regimen, and warm saturnine applications to the part. Cold applications are dangerous remedies, as they are apt to induce a permanent state of hardness in the gland. But the safest practice in this disease is to encourage suppuration. With this view, the whole breast should be enveloped in a large warm poultice, which should be changed four times a day, and at each change the breast should be steamed with hot water, or fomented for half an hour. When matter is once formed, the abscess should always be opened, which preserves the structure of the gland and the tone of the skin; therefore, as soon as the fluctuation is distinct, the matter should be discharged by the lancet. When abscesses form in different portions of the gland, each of them should be opened as they occur, and the opening should be sufficiently large to give free vent to the matter. By the continuation of the fomenting and the poultices, if there is no scrophulous tendency in the habit the inflammation soon abates, the discharge lessens, and the openings heal up; but, if this should not be the case, and any sinuses are discovered, these should be laid open throughout their whole extent, and the wound then dressed from the bottom. Any hardness which this disease leaves in the breast, in a sound constitution, generally soon disappears.

## SCROPHULOUS ENLARGEMENT OF THE MAMMA.

SCROPHULA is a disease much more frequent in women than in men; and, in habits afflicted with this complaint, the glands of the neck and of the mamma become frequently enlarged; therefore, scrophulous tumors of the mamma are very common, and are so apt to be mistaken for cancerous affections, that the breast is often extirpated on this account. Scrophulous enlargements occur early in life, generally terminate in suppuration, and frequently disappear after mammary abscess. The disease is characterised by the following marks:

The breast is in general much larger in scrophula than in scirrhus, and is less heavy for its size; the tumor is moveable, and does not adhere to the skin; the skin is smooth, and, although the tumor is large, the cellular substance can be felt betwixt the skin and the gland; when suppuration takes place, the skin ulcerates, and discharges a clear serum, sometimes pus, but most commonly a serum mixed with a curdly matter; and there is in general a succession of ulcerations, that heal up in one place and form in another. Scrophulous enlargement of the breast, when not attended with inflammation, has little or no pain.

## TREATMENT OF SCROPHULOUS ENLARGEMENT OF THE MAMMA.

THE local treatment of this disease should be the same as that recommended for mammary abscess, and the constitutional treatment the same as that which is laid down under scrophula, in the First Section of Specific Inflammation, vol. i.

## SARCOMA OF THE MAMMA.

THE mammary gland sometimes gradually increases in size, and, at the same time, becomes of a fleshy consistence, firm, and heavy. This state of the gland is attended with little pain, and any uneasiness which it occasions is chiefly from its weight; but, when the tumor becomes very large, the skin ulcerates, and the constitutional irritation is severe. In proportion as the breast enlarges, the internal venous circulation becomes obstructed, the subcutaneous veins swell, and, therefore, all tumors of this description, when they attain a certain magnitude, are attended with a varicose state of the superficial veins. Sarcoma of the mamma sometimes grows to a great size, and the disease is characterised chiefly by its firmness, weight, want of sensibility, and tortuous and varicose state of the subcutaneous veins.

## TREATMENT OF SARCOMA OF THE MAMMA.

In the treatment of this disease we have recourse to extirpation, as the only means of cure.

## SCIRRHUS AND CANCER OF THE MAMMA.

The doctrines of scirrhus and cancer, with the treatment applicable to these diseases, are fully laid down in the first volume of this work. The best practice in the cure of cancer is excision, and the breast requires more frequently to be removed on account of this disease than of any other.

## EXTIRPATION OF THE MAMMA.

It may be necessary to remove the female breast on account of sarcomatous enlargement, as well as other affections; but the disease for which the mamma is most frequently extirpated is cancer. When the breast is removed for cancer, it is of the first importance that the operation be performed early; and, to give confidence of success, all the diseased parts should be removed. Even when there is only a portion of the mammary glands apparently diseased, the whole breast should be removed; and if the axillary glands are affected, they should also be cut out.

When the breast is to be removed, the patient may be either placed on a chair, or laid upon a table: The chair is the most convenient posture for the operator; but, if the patient is feeble, and more especially if much hemorrhage is expected, a table is to be preferred. Previous to the commencement of the operation, an assistant must raise the patient's arm a little higher than a right angle with the body, so as to put the pectoral muscle on the stretch, and define the axilla. While the arm is in this situation, the surgeon makes two elliptical incisions, proportioned to the size of the breast, and at some distance from each other. These incisions should be in an oblique direction, with reference to the axilla and sternum, like the course of the fibres of the pectoral muscle: they should be carried completely through the skin fairly into the cellular substance; and the lower incision should be made first, because, if the surgeon commenced with the upper one, the blood running over the breast would obscure the track of the lower incision. After the completion of the external incisions, the skin is to be dissected back, so as to uncover the tumor; and, when this is accomplished, the surgeon should, at the upper angle of the wound, cut directly down through the cellular substance, till he reaches the fascia covering the pectoral muscle. In performing this incision, the long mammary artery will be divided, and the bleeding orifice should be covered by the finger of the assistant, till such time as the surgeon has removed the breast. When the surgeon has reached the pectoral muscle, he should raise the tumor from the upper angle of the wound, and, by dissecting from this point towards the sternum, and keeping the fascia in view, he will speedily remove the breast. But if the breast should adhere to the pectoral muscle, part of the muscle must be cut away, as it is of the first importance to remove the whole of the disease. By dissecting from the axilla towards the sternum, in the direction of the fibres of the pectoral muscle, not only will the operation be more quickly performed, but there will be no danger of raising the muscle, and the hemorrhage will be less, as the mammary artery will be cut but once.

After the breast has been removed, every artery which can be seen throwing out its blood in jets should be secured by ligature, the surface of the wound washed with warm water and a sponge, and not bound up till the general oosing ceases. The object of the operator should be to perform his operation in such a manner, that, when the breast is extirpated, the edges of the wound will come into contact; but, in those cases where the skin is diseased, or adhering to the tumor, it should be removed along with the diseased breast.

In those cases where there are diseased axillary glands, in their removal an incision must be carried either from the upper angle of the wound into the axilla, or, what is preferable, from the axilla downwards, so as to join the large wound at its upper angle; but, if the breast has been small, and the wound, which has been made for its removal, not large, more especially if the diseased glands do not form a large mass, there will be no necessity for joining the two wounds. In this case a portion of skin to the extent of half an inch, more or less according to circumstances, may be left betwixt them uncut. Previous to the surgeon commencing his incision, an assistant should force the points of his fingers deep into the axilla, betwixt the glands and the large veins, and, with his fingers in this situation, should push the diseased glands forwards so as to make them protrude, and form a distinct tumor. When fixed in this manner, the surgeon commences his incision upon the tumor, and carries his knife course of the fibres of the pectoral muscle: they should be carried completely through the skin fairly into the cellular substance; and the lower incision should be made first, because, if the surgeon commenced with the upper one, the blood running over the breast would obscure the track of the lower incision. After the completion of the external incisions, the skin is to be dissected back, so as to uncover the tumor; and, when this is accomplished, the surgeon should, at the upper angle of the wound, cut directly down through the cellular substance, till he reaches the fascia covering the pectoral muscle. In performing this incision, the long mammary artery will be divided, and the bleeding orifice should be covered by the finger of the assistant, till such time as the surgeon has removed the breast. When the surgeon has reached the pectoral muscle, he should raise the tumor from the upper angle of the wound, and, by dissecting from this point towards the sternum, and keeping the fascia in view, he will speedily remove the breast. But if the breast should adhere to the pectoral muscle, part of the muscle must be cut away, as it is of the first importance to remove the whole of the disease. By dissecting from the axilla towards the sternum, in the direction of the fibres of the pectoral muscle, not only will the operation be more quickly performed, but there will be no danger of raising the muscle, and the hemorrhage will be less, as the mammary artery will be cut but once.

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If the surgeon should be so unfortunate as to wound the axillary vein, he ought not to secure it by ligature, but suppress the bleeding by the introduction of a piece of dry sponge. I have seen this vessel wounded and included in a ligature, and the patient died of inflammation of the vein, which was ascertained by dissection: I have seen the vein wounded, and compressed by sponge, and the patient recover. In removing diseased glands from the axilla, it is the practice of some surgeons to put a large ligature behind the cluster of glands, and to allow them to remain till they fade away under the ligature; perhaps in some cases the profuse bleeding may render this practice necessary, but as it is far from being safe, it should always be avoided if possible. From the numerous branches of nerves in the axilla and groin, the application of ligatures to the root of tumors in these situations is extremely dangerous. In one case, in which I saw a ligature applied round the mass of diseased glands in the axilla, the patient died of locked jaw on the third day; and in another instance, where a tumor of an anomalous nature could not be entirely removed from the groin, a large ligature was applied round its root, and this patient also died of locked jaw.

When all the diseased glands have been removed from the axilla, the edges of both wounds are to be brought together and retained by a few stitches of the interrupted suture, with adhesive plasters laid in the interstices; but where the edges of the wound cannot be brought together, it must be dressed as an open surface with dry lint. A piece of simple dressing and compresses are then to be applied, and the whole secured by two rollers passed round the body. The rollers should be about five or six yards in length, and five inches in breadth. The first should be pulled with a moderate degree of firmness, but the second should be drawn pretty tight, with a view to keep up a firm compression, so as to repress any hemorrhage. Six or seven hours after the operation, the outer roller should be removed, lest the too tight pressure might induce inflammation and sloughing.

A

# SYSTEM

OF

# PATHOLOGICAL & OPERATIVE SURGERY,

FOUNDED ON

# ANATOMY:

ILLUSTRATED BY

DRAWINGS OF DISEASED STRUCTURE,

AND

PLANS OF OPERATION.

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BY

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IN THREE VOLUMES.

VOL. III. PART II.

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EDINBURGH:
*Printed by A. Balfour and Co.*
FOR MACLACHLAN & STEWART, EDINBURGH, AND
BALDWIN, CRADOCK, & JOY, LONDON.

1827.

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*Amputation at the Carpus* ........ 592
*Amputation at the Fore Arm* ........ 593
*Amputation in the Arm* ........ 595
*Amputation at the Shoulder Joint* ........ 596
*Amputation of the Toes* ........ 599
*Amputation of the Foot at the junction of the Metatarsal and Tarsal bones* ........ *ib.*
*Amputation through the Tarsus betwixt the Astragalus and os Scaphoides, and the os Calcis and Cuboides* ........ 602
*Amputation by a Flap below the middle of the Leg* 603
*Amputation below the Knee* ........ 605
*Amputation in the Thigh* ........ 607
*Amputation in the Thigh by two Flaps* ........ 610
*Amputation at the Hip Joint* ........ 611

⁂ *The description of the Plates relating to Hernia and Lithotomy, was the only part of this work left unfinished by the late Mr. Allan.* Mr. Marshall, *who had undertaken to furnish the Anatomical Views generally, has illustrated the former of these subjects by plates 16th and 17th, to which he has also added the necessary letter-press description. Another Plate on Hernia, and two on Lithotomy, were intended to be given; but the apprehension of a very inconvenient delay, has induced the publishers to bring out the work without them; a circumstance the less to be regretted, as plates 16th and 17th have been considered quite sufficient to illustrate the subject of Hernia; and as the highly valuable production of* Professor Monro, *on the anatomy of the pelvis, which cannot fail to be consulted by the student, presents all that he could desire on the subject of Lithotomy.*

## PLATE XVI.*

Exhibits a view of the Surgical Anatomy of the groin, after the integuments, subcutaneous adipose substance, and superficial fascia have been separated from it, and reflected upon the thigh; illustrating the natural structure of the external openings through which inguinal and crural herniæ protrude.

a. The integuments and subcutaneous adipose substance reflected.

b. The superficial fascia also reflected. The fascia superficialis, or fascia communis, is a distinct layer of condensed cellular tissue, which covers the tendon of the external oblique, spermatic cord, inguinal glands, and fascia lata; and separates these from a quantity of adipose substance between it and the integuments, which is always of a greater or less thickness, according to the fatness or leanness of the person.

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[*] The Reader, while consulting the plates of hernia, is requested to turn to pages 390 and 410 of the text.

c c. The tendon of the external oblique.

d. The anterior superior spinous process of the os ilium.

e. Tuberosity of the os pubis.

f f. The folded edge of the tendon of the external oblique, called the ligament of Poupart, extending between the anterior superior spinous process of the ilium and the linea ilio-pectinea and tuberosity of the os pubis, to each of which it is firmly attached.

g. An opening between two columns of the tendon of the external oblique, denominated the external inguinal ring, through which pass the spermatic cord in the male, and the round ligament of the uterus in the female. To bring this ring into view, as represented here, it is necessary, after the superficial fascia has been removed, to detach from its circumference, a thin layer of slightly condensed cellular membrane, known by the name of fascia propria of inguinal hernia; which, in the male, envelopes the spermatic cord, and, in the female, the round ligament of the uterus, so far as these are external to the ring.

h. The superior internal, or atlanto-mesial pillar of the ring; which, after crossing its fellow of the ring of the other side in the linea alba, is inserted into the symphysis pubis, and into the opposite pubis, in common with the pubic portion of the fascia lata, over the origin of the gracilis and adductor longus muscles. The body of the pillar, in this instance, was found divided into two portions, a disposition not uncommon, particularly in females.

i. The inferior external or sacro-lateral pillar of the ring. This pillar and Poupart's ligament unite, and are inserted into the tuberosity of the pubis, and into the pubis between its tuberosity and symphysis in the white line at k, and are also reflected into the fanlike appearance, seen emerging from behind the spermatic cord l, passing behind the superior pillar h, and proceeding towards the linea alba, into which they are inserted to the extent of an inch and a half above the pubes. This fanlike disposition of the fibres of the inferior pillar and Poupart's ligament, by crossing and adhering to the dermal or external surface of the conjoined tendons of the internal oblique and transversalis muscles, and in some parts, interlacing them, forms a protection to the cavity of the abdomen, behind the ring and above the pubes, which could not be so completely effected by any other arrangement of fibres with which we are acquainted. These fibres also, by being attached at such a height in the linea alba, serve as a bridle to maintain the fold in the crural edge of the tendon of the external oblique, for the lodgement of the spermatic cord in the male, and the round ligament of the uterus in the female; and they also of themselves act as a valve to the opening of which they form a part.

k. A tendinous band, continued from the inferior pillar of the ring and Poupart's ligament.

l. Spermatic cord, covered by the cremaster muscle.

m. Situation of the symphysis pubis.

n. These white lines represent fibres of the tendinous expansion of the external oblique, reflected, for the most part, from the anterior superior spine of the ilium d; and, after running for some way nearly parallel with Poupart's ligament, diverge from it, and cross the aponeurosis of the muscle from which they arose. Their use is to bind together the tendinous fasciculi which they are seen to cross; and as they traverse the triangular space o, between the two pillars i and h, they complete and strengthen the atlanto-lateral, or superior and external edge of the external inguinal ring.

It seems probable that, were it not for the above described arrangement of these reflected fibres, a number of herniæ would at once force a passage between two of the fasciculi of the tendon of the external oblique muscle, instead of traversing the course of the inguinal canal, towards the external ring.

o. A dark triangular space, rendered apparent by the direct fibres of the tendon of the external oblique being fewer in number here than at any other part of its expansion, occasioned by the diverging of the two pillars, which constitute the sides of the external inguinal aperture.

p. A braided texture over the situation of the rectus muscle, formed by a number of the direct and reflected fibres of the tendon of the external oblique interlacing. Perhaps they are mingled with some of those of the internal oblique, as the tendons of these muscles are at this part inseparably connected, and cross each other nearly in the direction exhibited by the texture. They are, at all events, mingled with a number of the fibres of the tendon of the corresponding muscle of the other side,—and *vice versa*.

q. That part of the fascia lata of the thigh, called its pubic portion, from its connexion with the pubes, covering the pectineus and adductor muscles.

r. The part of the fascia lata of the thigh known by the name of the iliac portion, from its connexion with the ilium. It covers the femoral vessels and muscles of the fore and outer side of the thigh. It is stronger than the pubic portion, and where it dips, on the pubal side of the femoral vessels, to unite with the pubic portion, it has a crescentic fold, which has been very properly named by my much respected preceptor, Mr. John Burns of Glasgow, its falciform process. The superior horn of which is connected with Poupart's ligament, and the pubic portion of the fascia lata which arises from the crest of the pubis on the linea ilio-pectinea; and its inferior horn is lost in the pubic portion of the fascia lata, behind the saphena vein. Underneath the edge of the crescent, and between it and the ilium, are a considerable number of oblique openings, which serve for the transmission of absorbents, blood vessels, and nerves. The part of it so perforated is called its cribriform portion. It is through one of these openings, which are situated underneath the edge of the superior horn, and opposite the white cross on the dark shade, representing the depression within the crescent, that femoral hernia protrudes.

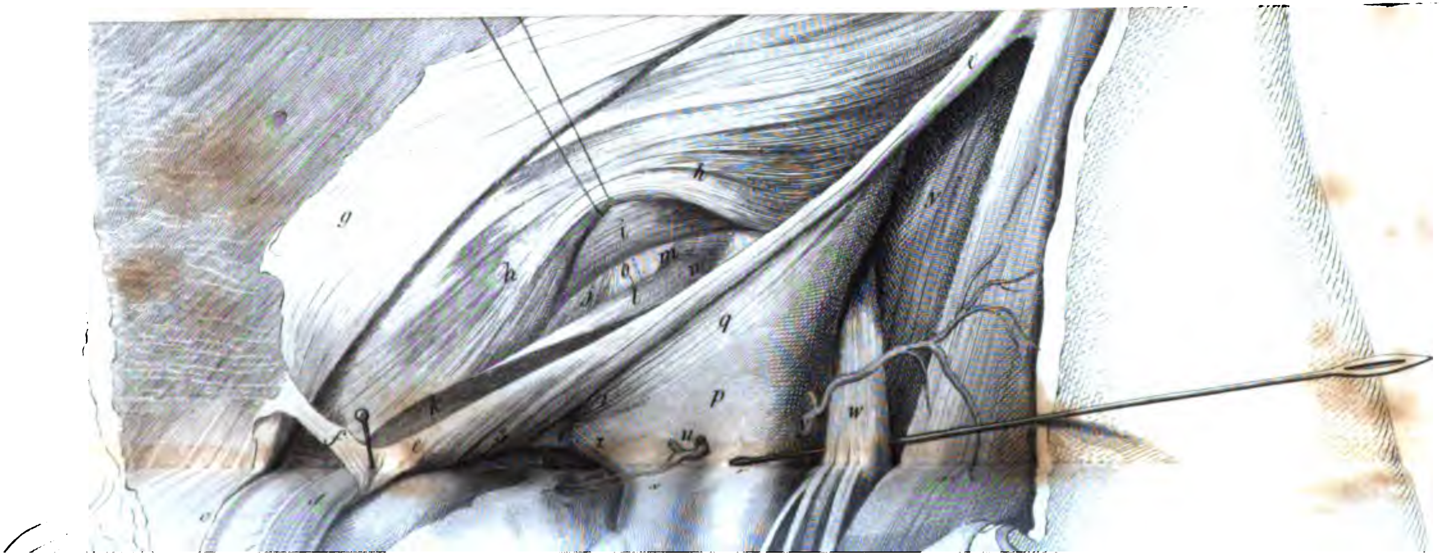
s. Falciform process of the fascia lata.

t. The vena saphena major, entering an opening in the cribriform portion of the fascia lata, immediately above the inferior horn of the falciform process, to join the femoral vein.

u u u u u. Inguinal absorbent glands.

v. The trunk of the superficial epigastric artery, seen sending off a number of branches to several of the inguinal glands.

w. An external pudic artery truncated.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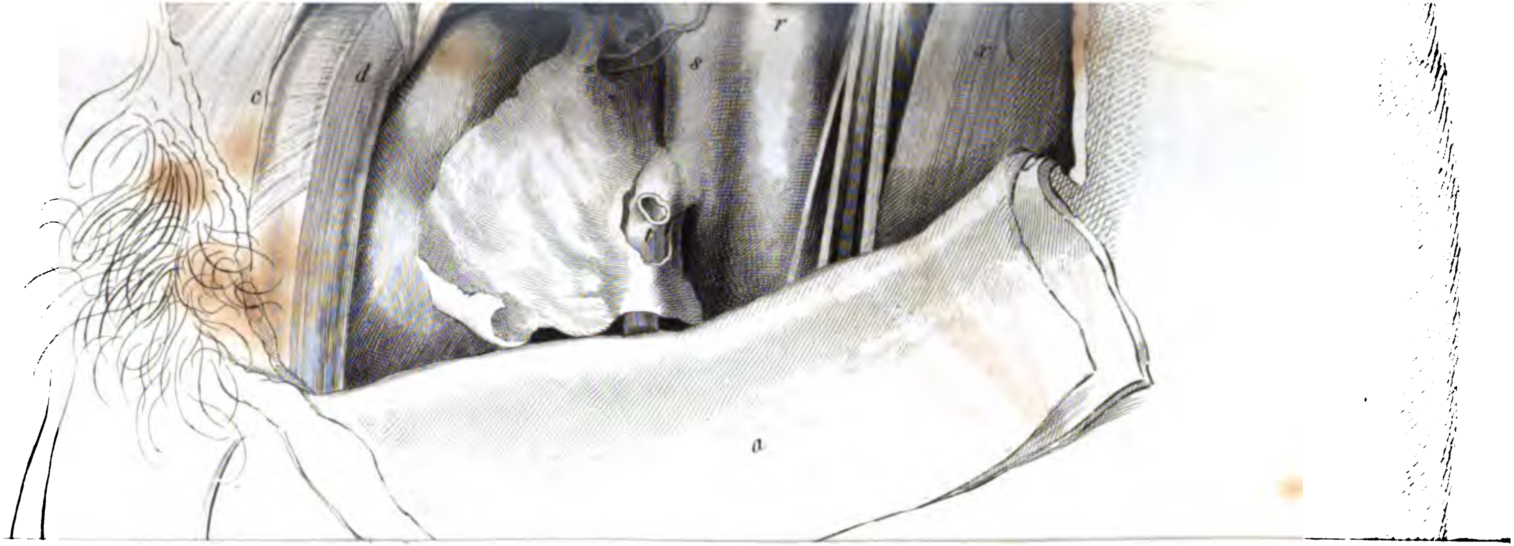
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## PLATE XVII.

Exhibits a view of the inguinal canal and the internal abdominal ring; and the relation of the parts, which form the stricture in femoral hernia, to the spermatic cord, and to the femoral vessels at their exit from the abdomen.

a. The integuments, subcutaneous adipose substance, and fascia superficialis communis, reflected from the groin.

b. Anterior superior spine of the ilium.

c. Symphysis pubis.

d. The spermatic cord, covered by the cremaster muscle, slightly diverted towards the pubis from its natural position, by means of a pin fixed in the tuberosity of the pubis, to retain the inferior pillar of the external abdominal ring, and Poupart's ligament elevated, so as to bring into view the parts which form the stricture in femoral hernia.

e e. Poupart's ligament.

f. The lateral arch of the external ring.

g g. The tendon of the external oblique, divided from Poupart's ligament and the lateral arch of the external ring, and reflected upon itself, to exhibit the crural edge of the internal oblique, and the part of the cremaster muscle in the inguinal canal.

h h. The internal oblique, separated from the part of the cremaster muscle k in the canal, and, throughout its looser cellular attachment, from Poupart's ligament e, and, being forcibly drawn upwards, by means of a thread, it carries along with it the crural edge of the transversalis muscle i, and exposes the spermatic cord l, a portion of the fascia transversalis m, and the whole of the internal inguinal ring n. The crural edge, both of the internal oblique and transversalis muscles, has been said to arise from the iliac half of Poupart's ligament. But these muscles, on the contrary, are at that part tendinous, and firmly adhere to Poupart's ligament only by means of condensed cellular membrane. The tendon of the internal oblique, arises from the anterior superior spine of the ilium, between the body of the internal oblique, and tendon of the external oblique, and in its course accompanying Poupart's ligament towards the internal ring, its fibres diverge to give origin to the fleshy part of the muscle. Some of the fibres of the internal oblique in immediate connexion with the crural edge of the transversalis, at the part where it comes in contact with the spermatic cord, sometimes arise by means of a tendinous band, of three or four inches in length, which is occasionally seen lying between the internal oblique and transversalis muscles, parallel to the crest of the ilium and Poupart's ligament.

i. The tranversalis muscle. The crural edge of this muscle is also said to take its origin from Poupart's ligament; but it arises from the inner edge of the whole of the anterior third of the crest of the ilium, in a broad flat tendon, which, passing between the body of the muscle and Cooper's fascia, in a line with the crest and Poupart's ligament, reaches to about a quarter of an inch on the iliac side of the internal ring. In the extent of its connexion with Poupart's ligament, it incorporates with the tendon of the internal oblique, and like it, diverges into the fleshy part of the muscle in connexion with the internal ring. The fibres which rise highest in the crest, give origin to the muscular part in contact with the spermatic cord, at the commencement of the canal.

The cremaster muscle has a like tendinous origin from the inner edge of the crest of the ilium, between the anterior and middle thirds; and it runs parallel with the tendon of the transversalis, to the lateral edge of the internal ring, and becomes fleshy where it unites with the spermatic cord. From the same part of the crest of the ilium there arises a tendinous band, which, proceeding parellel with, and adhering to, the iliac tendons of the transversalis and cremaster muscles, and also to the iliac fascia, as far as the lateral edge of the external iliac artery, crosses and incorporates with the forepart of the sheath of the femoral vessels, forming the inferior or lateral pillar of the internal ring, and is ultimately implanted in the crest of the pubis and tendon of the rectus muscle. Throughout its course between the ilium and lateral edge of the femoral vessels, it forms the bond of union between the iliac fascia and Poupart's ligament, and the fascia transversalis, and prevents the protrusion of the bowels between the ilium and femoral vessels. To distinguish it from Poupart's ligament, with which it lies in contact, it may be called the ilio-pubal ligament.

The tendons of the internal oblique and transversalis muscles, on the pubal side of the internal ring, form one of the boundaries to both inguinal and crural ruptures. Anatomists admit that the tendon of the internal oblique divides into two layers throughout the three upper fourths of the length of the abdomen; that one of these layers passes before the rectus muscle, along with the tendon of the external oblique, and the other behind it, along with the tendon of the transversalis towards the linea alba. In this way the sheath of the rectus is formed. But as the rectus has no aponeurotic sheath on its posterior surface throughout the inferior fourth of its length, it has been affirmed that the fibres of the internal oblique, and transversalis muscles, which should have formed the posterior sheath to the rectus, in this part unite with the anterior layer of the internal oblique, and pass wholly in front of the rectus to the linea alba. Such a disposition, although consistent with the opinion of Anatomists, does not accord with nature. The anterior layer of the tendon of the internal oblique, as in every other part of its extent with the tendon of the external oblique, proceeds before the rectus, to be attached to the linea alba, and forepart of the pubes between its tuberosity and symphysis. But the posterior layer, and the tendon of the transversalis, on reaching the lateral edge of the rectus muscle, are reflected and folded upon themselves, to proceed downwards towards the crest of the pubis on the linea ilio-pectinea, crossing the direct fibres on their posterior surface, at nearly right angles. These reflected fibres occupy the whole of the space between the internal ring, and lateral edge of the tendon of the rectus, to which they very firmly adhere at the angle of reflection. They pass between Gimbernat's insertion of the external oblique, and the ilio-pubal ligament, wind round the pubal extremity of the funnel-like sheath of the femoral vessels, and are inserted into the crest of the pubis on the linea ilio-pectinea, extending as far outwards as the lateral edge of the origin of the pectineus muscle. And a few of the fibres in connexion with the pubal side of the internal inguinal ring, are inserted into the ilio-pubal ligament, on the forepart of the sheath of the femoral vessels. The lateral edge of the reflected tendons of the internal oblique, and transversalis muscles, which embraces the pubal extremity of the funnel, defines the crescentic edge of the crural arch, extending considerably nearer the femoral vein than the external oblique.

j. A part of the reflected tendons of the internal oblique and transversalis muscles, seen issuing from behind the crural edge of the transversalis muscle, passing towards the linea ilio-pectinea and ilio-pubal ligament, and forming, with the fascia transversalis, the posterior boundary of the inguinal canal.

k. Cremaster muscle, seen emerging from behind Poupart's ligament, and covering a part of the spermatic cord in the canal.

l. The part of the spermatic cord which was covered by the transversalis and internal oblique muscles. I have invariably found that the spermatic cord passed underneath the crural edge of both the internal oblique and transversalis muscles without perforating either of them. And the whole of the fleshy fibres which I, at any time, found on the crural side of the spermatic cord, passed along with it through the external ring, and of course were fibres of the cremaster muscle.

m. Fascia transversalis, first accurately described by Sir Astley Cooper.

n. An opening in the fascia transversalis, denominated the internal inguinal ring.

o. Dotted lines representing the situation of the epigastric artery behind the fascia transversalis, in connexion with the pubal edge of the internal ring.

p. Infundibilum, or funnel-like sheath of the femoral artery and vein, which, independently of the cellular sheath in immediate connexion with the vessels, appears to be composed of two layers, the external of which is a process of the iliac fascia, and the internal, a process of the fascia transversalis.

# PLATE 21.

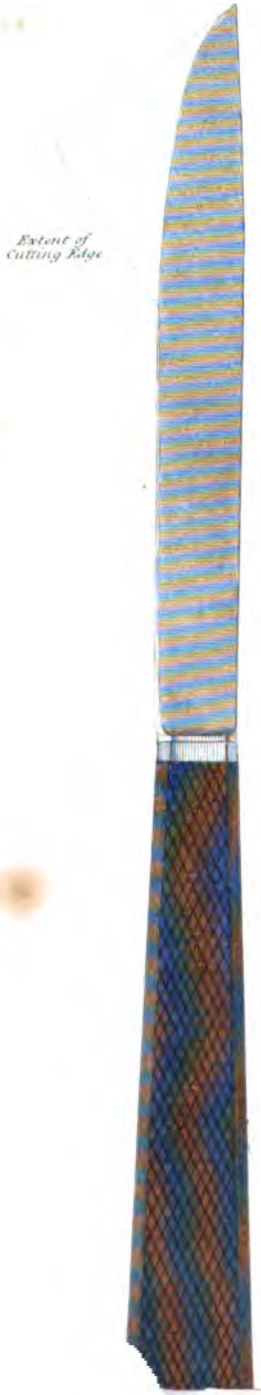

Fig 1.

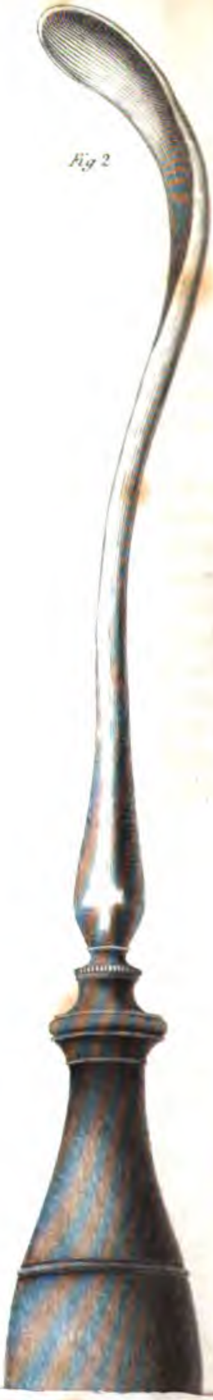

Fig 2

## PLATE XXI.

This Plate contains representations of the knife and of the lever which I have recommended to be employed in the operation of lithotomy.

Fig. 1st. represents the knife, which is similar to that used by M. Dubois of Paris. The handle and blade, being each four inches in length, give the surgeon a greater command than the common sized scalpel, especially in a deep perinæum. The extent of its cutting edge, which is convex, is about one inch and three-quarters in length, and its greatest breadth near half an inch. From the cutting edge being limited, the Surgeon can more freely introduce his finger into the wound to guide the knife, and there will be less danger of wounding the pudic artery.

Fig 2d. Represents the lever of its full size, an instrument which, in many cases, will be found superior to the forceps.

*The reader is requested to correct with the pen the following*

## ERRATA.

Page 369th, line 2, insert a comma after *is.*
489th, —— 8, instead of "*succulated*" read "*sacculated.*"
552d, —— 17, instead of a comma after *clitoris*, insert a semicolon.
Ibid. —— 19, instead of a comma after *Vagina*, insert a semicolon.

# CHAPTER XX.

## DISEASES OF THE ABDOMEN.

### GENERAL REMARKS ON THE STRUCTURE OF THE ABDOMEN.

There is no cavity of the body in which so many viscera are contained as the abdomen, and consequently whose pathology includes so extensive a range of local diseases; but, as we observed in our remarks on the structure of the thorax, these diseases fall rather under the province of the physician than the care of the surgeon. The physician has therefore a deeper interest than the surgeon in studying the minute anatomy of the abdominal viscera; but, to enable the surgeon to understand the nature and course of wounds; to give him a right conception of the true position of the intestines when fluid is accumulated in the abdomen; to enable him to comprehend the pathology of hernia, and skillfully to perform his incisions—it is necessary that he should be intimately acquainted with the situation of the viscera, and their external corresponding marks; also with the various connections of the peritoneum, and with the anatomy of the natural openings in the muscular parietes of the abdomen. On the two former of these points I shall now offer a few general observations, reserving the remarks which it may be necessary to make on the latter till we come to the subject of hernia.

1st, The older anatomists made an arbitrary division of the abdomen into distinct compartments or portions by means of imaginary lines drawn on its surface. These divisions of the cavity are so far of use in practice, that they render more intelligible the description of diseases and of operations. The young surgeon should therefore impress upon his mind the limits of each division, and the viscera that are contained within its boundaries.

The regions of the abdomen are easily defined by drawing two lines across its surface. The upper line must pass in such a direction as to touch the most prominent points of the ribs; and the lower line from one spinous process of the ilium to the other. These two lines will divide the abdomen into three portions, an upper, a lower, and a middle portion. That part which is situated above the centre of the upper line is called the epigastric region. It is circumscribed above by the ensiform cartilage; laterally by the cartilages of the ribs, and below by the upper line drawn across the abdomen. The sides of this upper portion are called the hypochondriac regions, and extend laterally to the spine. That portion of the abdomen which is below the middle of the lower line, betwixt it and the pubis, is called the hypogastric or pubic region, and its sides the inguinal regions. The middle of the portion betwixt the two lines is called the umbilical region; its centre is the umbilicus; and it embraces a space of the same extent, laterally as that which is above and below. Its sides are called the illiac regions; but that part which extends backwards, and is in contact with the spine, is named the lumbar regions.

All the abdominal viscera are apt to be displaced by accident or disease; and the situation of some of these organs, particularly the stomach and omentum, varies in the child from that in the adult; but, speaking in a general way with regard to the natural structure, we may say that the epigastric region is occupied chiefly by a portion of the stomach and the left lobe of the liver, and posteriorly by the pancreas; that the right hypochondrium contains the great bulk of the liver, with the gall bladder; and that the left hypochondriac region contains a part of the left lobe of the liver, part of the stomach and the spleen. The umbilical region is filled with part of the small intestines, covered by the omentum, and having the transverse arch of the colon crossing its upper part. The iliac and lumbar regions contain portions of the small intestines, a part of the colon, and the kidneys. The hypogastrium contains the small intestines, and the urinary bladder when much distended; and the inguinal regions are filled with the small intestines. The small intestines are situated chiefly in the middle and lower parts of the abdomen, while the large intestines form a circle which surrounds the small. The colon, beginning in the right iliac region, under the right kidney, runs upwards towards the right hypochondrium, and crosses the abdomen a little above the umbilicus, where it forms the great transverse arch. It then runs downwards through the left iliac into the left inguinal region, where its sigmoid flexure lies in the left groin, and it terminates at the top of the sacrum. From the situation of the great transverse arch of the colon, and from its connection with the stomach and liver, it follows that the chief bulk of old and large umbilical hernia is composed of this intestine and omentum; that a spasmodic affection of the colon is apt to be confounded by an ignorant practitioner with a similar affection of the stomach; and that an abscess in the liver not unfrequently bursts into the colon, and the matter is then discharged by stool.

2d, The second important point in the surgical anatomy of the abdomen, is the manner in which the peritoneum lines the abdominal muscles, and is reflected upon the viscera, forming the different ligaments which support them, and separating this cavity from the pelvis. When the abdomen is opened, and the muscular flaps folded back, we perceive that they are lined with a pretty strong membrane, which, when torn off from the muscles, will be found rough and cellular externally, but smooth and glistening within, having the character of a serous membrane. If the peritoneum be traced from the inner surface of the transversalis muscle in a lateral direction, it will be found to pass off from the muscle, and to give a covering to the viscera but in such a manner that, strictly speaking, they may be said to be situated beyond this membrane. It will be seen that the peritoneum can be torn up from the loins, and stripped from the intestines; and all those viscera which can be raised or displaced by the hand, are completely covered by the peritoneum, while those which are closely fixed down, as the caput coli and the kidneys, are only partially covered. The peritoneum not only lines the abdominal muscles, but gives a covering to the abdominal surface of the diaphragm; and it can also at this point, although with more difficulty, be traced from this muscle over the viscera. At the lower part of the pubis the same membrane may be traced from the muscles to the bladder, along its anterior surface covering its fundus, then passing down its posterior surface nearly till it reaches its neck; from which it will be found to be reflected in the male upon the rectum, so as to form a cul-de-sac at this point, betwixt the rectum and bladder; but, in the female, it passes off from the bladder to the uterus, covers it in the same way as the bladder is covered, and is ultimately reflected upon the rectum. By the manner in which the peritoneum passes off from the muscles, and covers the pelvic viscera, it forms a septum betwixt the pelvis and abdomen.

The structure of the peritoneum renders it very susceptible of inflammation, and from the manner in which it lines the abdominal muscles, and covers the bowels, it is always carried before any of the viscera which protrude, so as to form the herniary sac. From its inflections, it is also evident that, when water is collected in the belly, the fluid must be contained in a distinct sac, the anterior part of which is the peritoneum lining the abdominal muscles, and the posterior part the peritoneum covering the viscera; that in proportion as the water accumulates the intestines will be pushed back; and that there are three points at which the water may be evacuated, viz. through the walls of the abdomen, which is the place generally chosen; from the upper part of the vagina in the female, by opening into the blind sac, betwixt the uterus and rectum, which is a safe procedure; or from the rectum in the male, an operation which should not be attempted.

## ASCITES.

Ascites is a collection of a serous fluid in the peritoneal sac within the abdomen. The disease may be produced by a variety of causes, but most commonly arises from debility in the extreme vessels, or from obstruction in the venous and lymphatic circulations, in consequence of an enlarged viscus, such as a diseased liver or spleen.

When fluid is accumulated in the abdomen in considerable quantity, there is great tumefaction of the belly, a protrusion of the umbilicus, a distinct sense of fluctuation when the hand is laid on one side, and the opposite tapped on or struck gently with the fingers, and not unfrequently a distended state of the subcutaneous veins. Besides these local symptoms of ascites, the pulse is quick and small, there is great thirst, with hot skin, and the urine is high-coloured and secreted in small quantity. The fever increases towards evening, the breathing is difficult, especially in the horizontal posture, or when the belly is pressed on, and there is general emaciation. The fluid is not always contained in the sac of the peritoneum, but the dropsy is sometimes encysted; and although this circumstance does not preclude an operation for its removal, still it is desirable to ascertain when this is the case, as there is a difference in the place of puncture. When the disease commences in the form of a circumscribed swelling in a particular part of the abdomen,—when the belly is distended slowly,—when the fluctuation is perceptible in one part, but cannot be distinguished in another,—and when there is no protrusion of the umbilicus the dropsy may be accounted encysted; but when the tumefaction is general,—when the fluctuation can be felt over the whole surface,—when there is a protrusion of the navel,—and when the accumulation has taken place rapidly, the dropsy will be found to be situated in the general cavity. When the dropsy is general, the fluid is watery, and of a yellow colour like urine, but when encysted, it is sometimes thick and ropy, and I have seen it on one or two occasions resembling pus.

## PARACENTESIS ABDOMINIS.

When fluid is collected in the abdomen in such a quantity as to be productive of distress, and to disorder the functions, it will be necessary to remove it by a surgical operation. This is more especially the case when the physician is unsuccessful in his mode of treatment, and the patient is becoming daily more and more oppressed from the increased accumulation. The operation of paracentesis is simple in itself, and, when performed in a proper situation, is void of danger. It does not interfere with the exhibition of general remedies, but greatly assists in effecting a cure, by relieving the abdominal and thoracic viscera from oppression.

When performing this operation, a circumstance of chief importance is, to keep up the same degree of pressure on the viscera and blood vessels which is done by the water, for if this is not attended to, the patient will faint, and may actually die, or the fainting may induce such a depression that he will not recover. For this purpose, a table napkin, broad flannel bandage, or other belt, should be applied round the abdomen, in such a manner that it may be gradually tightened as the water is evacuated.

A few years ago, surgeons were wont to tap in the sides of the abdomen. They imagined a line drawn from the umbilicus to the anterior superior spinous process of the ilium on the left side, and they took the centre of this line as the point where the trocar was to be entered. In this situation they conceived that the instrument was always passed through the linea semilunaris, that, of course, there was no depth of muscular substance to perforate, and that there could be no danger of wounding any blood vessel. But as the parietes of the abdomen do not distend equally, it has on some occasions happened that the point of the trocar has passed through the rectus muscle and wounded the epigastric artery, in consequence of which accident, the patient has bled to death, and upon dissection, the abdomen has been found filled with extravasated blood. To prevent the possibility of such an occurrence; surgeons now tap in the linea alba; and the best situation for this purpose is about two inches below the umbilicus. The bandage must be first applied, having a hole in it at the point the trocar is to be inserted, and the patient, unless he is very weak, should be placed in an armchair in an upright posture, as being the most favourable for the operation. The surgeon then, with the handle of the instrument resting in the palm of his right hand, and his fore-finger upon the canula, having previously dipped its point in oil, carries it cautiously and steadily into the abdomen, when the canula is to be taken hold of with the thumb and fore-finger of the left hand, and gently pushed farther in, while the trocar is withdrawn. The surgeon will easily ascertain when he has entered the abdomen, from the resistance to the instrument ceasing. In proportion as the fluid is evacuated the bandage must be tightened, so as to keep up a continued compression, and, should the patient become faint, the flow of the water should for a time be suspended, by the surgeon placing his finger upon the end of the canula. It sometimes happens that the discharge is suddenly stopped by a portion of omentum, or of coagulating lymph plugging up the canula; in which case, a thick blunt probe must be gently introduced to clear the instrument. After the water has been evacuated, the canula is to be withdrawn, a bit of plaster or lint applied to the wound, and the bandage tightened, or a roller passed firmly round the abdomen.

Although it be the common practice of surgeons to perform paracentesis abdominis, by puncturing in the linea alba, the water may be evacuated with equal facility and safety, by entering the trocar at the upper part of the lumbar region.* I may farther remark, that it often happens in females, when the dropsy has been of long continuance, and the abdomen is much distended, the vagina protrudes, forming a tumour between the labia. When this is the case, the operation may be safely and effectually performed by puncturing in the vagina.* When the dropsy is encysted, the operation will be performed with more safety and certainty the longer it is delayed; because it is some time before the sac adheres to the peritoneum, and until this adhesion take place, the viscera are not only in danger, but the internal orifice is apt to slip from the canula, and thus prevent the escape of the fluid.

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* Le Dran frequently performed the operation in this manner. See Operations in Surgery, by M. Le Dran. This was

In ascites, we never know whether or not the operation is to effect a cure, but we should consider no case as desperate. Desault relates a case where a female, even in the decline of life, recovered after being tapped thirty-two times; and there are many cases on record where the operation has been performed much oftener, and ultimately with success. Hautesierk informs us of a cure after the patient had been tapped sixty times in the space of two years and a half. The operation was assisted by a continued use of aperients and tonics.

also the practice of my respected master, the late Mr. John Bell; in which case the patient was laid in a horizontal posture on a bed or a sofa.

* Cases of this nature are recorded in the Medical communications, by Mr. Watson and Sir William Bishop.

## HERNIA.

The escape of any of the viscera through the natural, or through artificial openings in the abdomen, forms the disease called hernia. There is no disease more frequent in its occurence, or more dreadful in its consequence; and there is none therefore which has a greater claim to the regard of the surgeon. Every condition in life is liable to hernia, the infant and the aged, the feeble and the strong, the indolent and the laborious. It may be added, there is no treatment, however severe, a patient will not undergo to get cured of so annoying a complaint; and hence, there is none which has given rise to more cruel and dangerous operations.

The attention that has of late years been bestowed upon the surgical anatomy of the parts involved in hernia, conjoined with pathological enquiries, has, no doubt, led us to form more correct notions of the nature of this disease, but the great modern improvements in the treatment of hernia are its retention, by means of spring trusses, and an early recourse to operation when strangulated.

## CAUSES OF HERNIA.

A continued and uniform pressure is kept up upon the viscera contained in the belly, by means of the diaphragm and abdominal muscles. If any of the natural openings are enlarged, this continued pressure will push the bowels through them, or if the pressure be increased by any sudden or over-exertion, these openings will be forced, and the bowels will escape. The two great causes, therefore, to which the origin of hernia may be ascribed, are general relaxation, and sudden exertion. The first of these occasions the frequency of the disease in children and in the decline of life, when the hernia sometimes attains an immense size. The second cause, sudden exertion, is productive of immediate and dangerous hernia. Often by violent exertion, such as lifting heavy weights, straining at stool, vomiting, or leaping, the bowels suddenly protrude, at other times they escape gradually through the natural openings. These openings are so enlarged by distension in pregnancy and in ascites, that umbilical hernia is particularly frequent in those who have been in this situation.

But independently of general relaxation, sudden exertion or over distension of the abdominal parietes, there seems to be a predisposition to rupture in some families, in whom the natural openings in the abdomen are preternaturally large. In such the bowels protrude without any over-exertion, as in the ordinary states of breathing, and by the common action of the abdominal muscles. The frequency of hernia in France and Italy has been ascribed to eating great quantities of oil; but hernia being so common in these countries, may be more justly imputed to the relaxation which prevails in a warm climate. When hernia is produced by strains, falls, or blows upon the belly, the protrusion is sudden, the opening is small, and the danger is considerable; but when it comes on slowly, and is imputable to general weakness or relaxation, the opening is free, and the danger less. If we attend to the cases of hernia which present themselves, we shall find that men, from their greater exertions, are more subject to the disease than women, and that it occurs much more frequently on the right side than on the left. It has also been remarked, that hernia prevails among cavalry in a much greater proportion than amongst foot soldiers.*

## VARIETIES OF HERNIA.

As the contents of the abdomen may protrude not only through the natural openings, and those arising from malformation, but also through artificial ones, formed in consequence of wounds, there must be a great diversity both in the form and in the consequences of hernia. The varieties of the disease have been designated by distinct names, derived chiefly from the situation and from the contents of the tumor. By attending to the natural openings in the abdomen, we shall see that there are many points at which the bowels are apt to protrude, and by comparing these openings with each other, it will be found that age and sex have a manifest influence in determining the species of the disease.

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* Lawrence on Hernia.

There are many natural openings through which the bowels may escape; and in consequence of a wound a hernia may occur at any part of the abdominal surface; but the points at which it most frequently descends are the umbilicus, the inguinal canal, and the femoral ring under Poupart's ligament.

1st, The umbilicus is the most defenceless point in the abdomen, as the opening is direct. Still hernia does not occur at this place so frequently as at the groin, because, from being situated high, it is not so much acted upon in the erect posture by the diaphragm and abdominal muscles. The umbilicus is much stronger in the adult, particularly the male, than in the child, and in the former it is strengthened by the action of the abdominal muscles. A protrusion in the male seldom occurs here, but in the female is very frequent. In consequence of pregnancy the abdominal parietes are stretched, and the opening at the umbilicus is enlarged; a hernia at this point is therefore very common in pregnant women. From having once taken place the part remains weakened, and the hernia either continues, or is apt to return in every future pregnancy.

The umbilicus is the place which, in the fœtus, gives passage to the vessels of the chord, and although the opening has, after birth, a natural tendency to contract, as the child advances in years and increases in strength, yet it sometimes happens that, from frequent crying, the umbilicus yields, and a protrusion takes place; a hernia here is therefore a frequent occurrence in infancy. A protrusion at the umbilicus also frequently presents itself in patients labouring under ascites for the same reasons that it occurs in pregnancy. The subjects therefore most liable to this species of rupture are females, particularly during pregnancy, young children, and ascitic patients. It is termed exomphalos or umbilical hernia.

2d, The abdominal ring is another weak part, particularly in the male, and more especially in infancy and in the decline of life. In the former, from the opening being direct, and in the latter, from the relaxation peculiar to old age. In the male, the inguinal canal gives passage to the spermatic chord; the chord, according to the different states of the cremaster muscle, is occasionally shortened and lengthened, which keeps the opening free, and the testicle passes through at this opening to get into the scrotum. Conjoined with these circumstances, the occasional violent exertions and laborious occupations to which the male is subject, renders hernia at this place frequent in them. But in the female nothing passes through the ring, except the round ligament of the womb to be inserted into the top of the thigh. This ligament is small when compared with the spermatic chord, the ring is therefore less, and as the ligament is not subject to the same contractions and elongations of the chord, there is a general adhesion which closes up the opening.

In male infants, from the testicle being sometimes long of passing into the scrotum, and from the relaxation peculiar to infancy, conjoined with violent crying, the bowels often protrude at the ring. This accident is more apt to occur from the inner ring or opening being placed directly opposite to the external one, for it is only as we advance towards the adult state that the canal takes an oblique direction, and that the inner ring becomes situated nearer the superior spinous process of the ilium. Hernia through the ring, therefore, occurs very frequently in boys. When this hernia occurs in women, the protruding bowel sometimes descends into the labium pudendi, and when it takes place in men sometimes into the scrotum. When the tumor is situated in the groin, the disease is termed bubonocele or inguinal hernia, and when it descends into the scrotum, oscheocele or scrotal hernia.

The scrotal hernia of boys, with reference to its immediate seat, often differs materially from that of men. As the peritoneum lines the inner surface of the abdomen, this membrane is carried before the protruded bowel, forming the hernial sac; but in one species of scrotal hernia, and which is more apt to occur in boys than in men, the hernia has no peritoneal sac, but lies in immediate contact with the testicle. The tunica vaginalis forms its only sac, a circumstance which is produced in tha following manner. While the fœtus is in utero, the testicle is situated within the abdomen, a little below the kidney, and is covered, like the other viscera, by the peritoneum. About the fifth or sixth month it begins to approach the abdominal ring, and in general, about the seventh month, passes through it into the scrotum. The covering which the testicle derived from the peritoneum while it lay in the abdomen, forms the tunica albuginea, and as it passes through the ring, it carries before it the peritoneum, which forms the tunica vaginalis. According to this constitution of things, it is evident that while the testicle is passing through the ring, and even for some time after it is in the scrotum, there must be a communication betwixt the abdomen and the cavity of the tunica vaginalis. This communication in general is soon cut off by the gradual contraction and final closure of the opening. This event most commonly takes place before birth, sometimes shortly after it, but occasionally not for a long time. While this communication betwixt the abdomen and tunica vaginalis exists, there is nothing to prevent a portion of intestine or omentum from descending, and if this should take place, the protruded bowel must be in immediate contact with the testicle. This species of hernia has been called hernia congenita. It is sometimes difficult to distinguish it from the common scrotal hernia, but this is of no consequence, as the distinction is of no use in practice.

It sometimes happens when the opening betwixt the abdomen and tunica vaginalis has been recently closed, but before the passage is completely secured by the general contraction of the tunica vaginalis round the spermatic chord, that a portion of bowel enters the ring. In this case, the peritoneum will be carried before the protruding bowel, and will descend with it into the tunica vaginalis, so as to be placed in the same sac with the testicle. This species of hernia was first taken notice of by Mr. Hey, but has since been several times observed. It has been called hernia infantilis, as taking place only in early infancy.

3d, The crural aperture can never be dilated to the same extent with the abdominal ring, and there is, therefore, less risk of hernia at this place than at the groin. The greater part of the space under Poupart's ligament is closed up by muscles and the blood vessels of the thigh, and farther secured by the union of the connecting fasciæ; but betwixt the vein and the pubis, the opening is filled up only by cellular substance through which the lymphatics pass into the abdomen. At this point the bowels sometimes protrude, although the opening is guarded in the violent action of the abdominal muscles by the firm bracing down of the fascia lata which is attached to Poupart's ligament. From the size and depth of the crural arch in the female, protrusions at this place are frequent in that sex, particularly after the age of puberty, for previously to this time of life the female pelvis is nearly of the same dimenmanner. While the fœtus is in utero, the testicle is situated within the abdomen, a little below the kidney, and is covered, like the other viscera, by the peritoneum. About the fifth or sixth month it begins to approach the abdominal ring, and in general, about the seventh month, passes through it into the scrotum. The covering which the testicle derived from the peritoneum while it lay in the abdomen, forms the tunica albuginea, and as it passes through the ring, it carries before it the peritoneum, which forms the tunica vaginalis. According to this constitution of things, it is evident that while the testicle is passing through the ring, and even for some time after it is in the scrotum, there must be a communication betwixt the abdomen and the cavity of the tunica vaginalis. This communication in general is soon cut off by the gradual contraction and final closure of the opening. This event most commonly takes place before birth, sometimes shortly after it, but occasionally not for a long time. While this communication betwixt the abdomen and tunica vaginalis exists, there is nothing to prevent a portion of intestine or omentum from descending, and if this should take place, the protruded bowel must be in immediate contact with the testicle. This species of hernia has been called hernia congenita. It is sometimes difficult to distinguish it from the common scrotal hernia, but this is of no consequence, as the distinction is of no use in practice.

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The protrusions of the viscera through the umbilicus, through the inguinal canal, and under the crural arch, constituting respectively exomphalos or umbilical hernia, bubonocele and scrotal hernia, and femoral or crural hernia, are the species of ruptures which most commonly occur. Other varieties of this disease have occasionally been observed both by the older and modern surgeons, but are more particularly described by the writers of the present day.

In consequence of wounds of the abdominal muscles or laceration of their tendons, of childbearing, malconformation, &c. portions of the bowels frequently protrude from the abdominal surface. This may occur in any part of the abdomen, but most frequently takes place betwixt the recti muscles. This species of the disease is termed ventral hernia; it is of rare occurrence; easily reduced; but difficult to retain.

Amongst other points, it has been observed that a protrusion has sometimes taken place at the thyroid hole and the sacro-sciatic notch. The thyroid hole is so filled up by ligament and muscles, that a hernia here is a very rare occurrence; however, a portion of intestine or omentum is sometimes found to pass out at that opening, which transmits the obturator artery, vein, and nerve, giving rise to what has been called thyroideal or obturator hernia. This species of the disease seldom appears in the form of a tumor outwardly, and can only do so when very large. The sciatic notch is situated so low, and is so filled up by the pyriform and other muscles, sciatic nerve, and blood vessels, that hernia here must also be a rare occurrence. However, there are cases on record, where both intestine and omentum have passed through this opening. One, in particular, by Sir A. Cooper; and another very remarkable one by Haller. This rupture has been termed dorsal or ischiatic hernia.

In men a portion of the floating viscera sometimes falls down into the perinæum, betwixt the rectum and bladder, forming a species of hernia; and in women the same thing is apt to occur betwixt the rectum and vagina. This species of the disease is termed perinæal hernia; it is not characterised by any outward swelling, and can be felt only from the rectum or vagina.

In the female also, a portion of intestine sometimes slips down betwixt the vagina and ramus ischii, forming a tumor in the labium of an oblong shape. A tumor is likewise sometimes formed in the vagina within the os externum, by the gut passing down betwixt the rectum and uterus; in abdominal ring than the large, although the sigmoid flexure of the colon not unfrequently forms the contents of inguinal hernia on the left side, and the caput coli sometimes descends on the right. The urinary bladder is also sometimes herniated through the ring.

It is generally the small intestines which are protruded under the crural arch. From the smallness of the opening, and from the firm connections and unyielding nature of the fascia, this hernia is in general small. Sometimes it is so small as not to include the whole circle of the gut, and is then very apt to escape detection. From being firmly compressed, bad symptoms very soon succeed, so that crural hernia may be justly considered the most dangerous kind of rupture.

Although the contents of the hernia, in general, consist of those viscera which are situated opposite to the opening through which the bowels have protruded, this is not always the case. Mery saw the cœcum and commencement of the colon form a large hernia on the left side of the scrotum;* and Lassus relates a curious case, where the sigmoid flexure of the colon was herniated through the abdominal ring on the right side.†

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* Mem. Acad. des Sciences, An. 1701, p. 289. Obs. 5. And Haller Disp. Chir. vol. iii. p. 32.

† Lassus, tom. ii. p. 31.

## HERNIAL SAC.

From the manner in which the peritoneum lines the abdominal muscles, and is reflected upon the viscera, every protruding bowel so enveloped in its natural state, must carry that membrane before it, and thus a sac or covering is formed for the hernia. The only exception to this rule is that species of hernia called congenital, for which we have assigned a reason. But while those viscera which are naturally covered by a peritoneal coat have a hernial sac, those which have no such coat, or are but partially covered by peritoneum, can have no sac, or one to a certain extent only. This is the case with the urinary bladder as well as with the cœcum and caput coli. When the body of the bladder is herniated there is no hernial sac, because it has no peritoneal covering; but when the fundus of that viscus also protrudes, the rupture is partially covered with a sac, and when the cœcum and caput coli pass into the scrotum, they can have a hernial sac only on the inner and anterior part. From the cœcum being tied down in the right ileo-lumbar region, and imbedded in cellular substance, it is not covered by peritoneum on its posterior and outer part, hence, in ruptures of this portion of the alimentary canal, the posterior and outer part will be in contact with the cellular substance, while the anterior and inner part will be covered by a sac. It has been well remarked by Scarpa, that in ruptures of the cœcum and caput coli, when the hernia is small, there will be no adhesion of the gut to the sac, because the lower or pendulous part of the cœcum does not adhere to the peritoneum within the abdomen; but when the hernia is large, and the whole cœcum involved, there must always be an adhesion to the hernial sac, as this peritoneal adhesion existed before the descent. When the cœcum is wholly protruded, the rupture will therefore be irreducible, in consequence of this adhesion.

When the bowels protrude, the peritoneum is carried before them, and by being separated from the inner surface of the abdomen this membrane inflames, in consequence of which it both becomes thicker, and adheres without the abdomen, to the cellular substance with which it comes in contact. This adhesion in general prevents it from being returned with the protruded bowel. I say in general, because I am aware that in small and recent hernia it is quite possible to return the sac with the intestine. This is particularly the case in inguinal and crural hernia; and I have, on several occasions, during the operation for crural hernia, seen the sac returned with the intestine. The young surgeon should recollect the possibility of this occurrence, as in some cases he is apt to mistake the sac, especially when very thin, for its contents, and by returning it unopened, the strangulation may be continued, and the patient will die unrelieved. But in general, the sac is so fixed by adhesions, that it cannot be returned; and when the hernia is reduced, the intestine or omentum is pushed through the neck of the sac, while the sac itself remains external to the abdomen, and its place is indicated by a greater degree of fulness than on the opposite side. In large scrotal hernia, of long continuance, after the bowels are reduced, the sac can be felt bulky in the scrotum. When the quantity of the protruding bowels is increased, and the hernia becomes large, more of the peritoneum is pushed out, and the size of the sac is increased.

## MARKS OF HERNIA, AND DISEASES WHICH MAY BE MISTAKEN FOR IT.

It is not so much by the situation or appearance of a disease as by its history, that we pronounce an opinion upon its nature. There are many tumors situated about the groin and scrotum, and apparently in connection with the inguinal or crural ring, which have so close a resemblance to hernia that it is sometimes difficult to decide upon the exact nature of the case; and when a hernia is irreducible, when the protrusion consists only of omentum, more especially in fat people, or when a rupture is combined with an enlargement of the inguinal glands, the diagnosis is often extremely difficult, but by careful examination, and by attending to the history of the case, the existence of hernia may in general be determined. When the tumour has appeared suddenly after some over-exertion—when it can be made by pressure to disappear in the horizontal posture,—when the swelling is sometimes entirely gone, or varies in size,—when there is an impulse given to the tumor on coughing, and more especially when its appearance is attended with nausea, colic pains, costiveness, and other marks of derangement in the alimentary canal, there can be little doubt of the existence of hernia.

We have already remarked, that the fixed, as well as the floating viscera of the abdomen, may be so displaced as to be engaged in hernia, but that the contents of the tumor most frequently consist of intestine or omentum, or of both. When the rupture consists of intestine, it has a smooth and elastic feel; the patient is sensible of flatus occasionally passing through it,—an impulse is given to the swelling on coughing, and when pressed on, it retires within the abdomen suddenly, and most commonly with a guggling noise. When the contents are omentum, the rupture wants the full and defined form which characterizes enterocele, and is slower in its progress; the tumor is unequal on its surface, and has a doughy feel; there is no impulse communicated to it on coughing; when pushed back into the abdomen, it recedes slowly, and its reduction is not attended with that guggling noise which is present in intestinal hernia. Independently of these characterizing marks, I may observe, that intestinal hernia generally appears suddenly, while omental hernia always makes its appearance slowly, and becomes larger by degrees. When the rupture is composed of intestine as well as omentum, it will form an entero-epiplocele, and partake of the characterizing marks of both intestinal and omental hernia.

Surgical systematic writers have been in the habit of enumerating several diseases which are apt to be mistaken for inguinal, for scrotal, and for crural hernia, but more especially for the two former. These are bubo, lumbar abscess, hernia humoralis or inflamed testicle, circocele or a varicose enlargement of the spermatic veins, hæmatocele or bloody tumor of the tunica vaginalis or spermatic chord, hydrocele of the tunica vaginalis; but particularly hydrocele of the spermatic chord, and the testicle, when situated in the groin, and before it has descended into the scrotum. If the surgeon is the least attentive to the history of the case, and has any knowledge of the anatomy, there will be little danger of his confounding any of those diseases which we have enumerated with hernia, except circocele and hydrocele of the spermatic chord.

Bubo may always be easily distinguished from inguinal hernia, by its hardness and circumscribed form; by its situation being placed much below the ring; by the surgeon being able to trace the spermatic chord into the abdomen, and feeling it unconnected with the tumor; by the redness of the skin when the gland is much inflamed, and by the fluctuation when suppuration has taken place—a feeling quite different from that of intestine or omentum.

Lumbar abscess may be known by the previous history, such as the appearance of the tumor having been long preceded by pain in the loins, by the swelling acquiring a more flattened form in the horizontal posture, by the fluctuation, and by the surgeon being able to trace the spermatic chord, and feeling it unconnected with the tumor.

I cannot conceive how inflammation of the testicle should be classed amongst those tumors which may be mistaken for hernia. The diagnostic symptoms of the one are so completely different from those of the other, that nothing but the most unpardonable negligence or gross ignorance can confound them. In hernia humoralis there is great pain, enlargement, and hardness of the testicle, redness of the skin, fever, a want of fullness in the chord, and the swelling is generally preceded by gonorrhœa.

Circocele is very apt to be mistaken for hernia; and by careless or ignorant practitioners is every day mistaken for an omental hernia. Like hernia, it appears in the erect posture, and disappears in the horizontal one; its size is increased upon coughing, and it has precisely the feeling of a piece of omentum. There is only one way, as Sir A. Cooper observes, of discriminating betwixt the two diseases. Let the patient be laid in the horizontal posture and the tumor of the scrotum emptied by pressure. The surgeon should then grasp the upper part of the chord close by the abdominal ring, betwixt his fore-finger and thumb; and while it is held in this manner, the patient should be desired to raise himself to the upright posture. If the tumor be a hernia, it will not reappear as long as the pressure is continued; but if the disease be a dilated state of the veins, the swelling will not only instantly reappear, but will be much increased in size from the obstruction to the refluent blood.

The only species of hæmatocele which could for a moment be confounded with hernia, is that which arises from the bursting of a branch of the spermatic vein, in consequence of a blow or over-exertion. The blood is poured out under the spermatic sheath, and a tumor is thus formed in the course of the chord. This disease may be easily distinguished from hernia, by the surgeon not being able to make the tumor disappear when the patient is laid in a recumbent posture; by the tumor not being affected by coughing; and by the abdominal ring and upper part of the chord being felt unconnected with the swelling.

Hydrocele of the tunica vaginalis always begins at the bottom of the scrotum, whereas hernia descends from the top. The tumor is in general of a pyramidal form with the penis shortened and buried in its substance, is not affected by coughing, and cannot be returned into the abdomen. If the patient be laid in a recumbent posture, and the contents of the tumor be pressed towards the abdomen, we can see its termination at the ring; the spermatic chord can be felt free and small, particularly at its upper part; and if the tunica vaginalis be not much thickened, the tumor is transparent when a lighted candle is applied.

The encysted hydrocele of the spermatic chord may be distinguished from hernia, by the gradual increase of the tumor; by its incapability of being returned into the abdomen; by no impulse being communicated to it on coughing; and by the chord, as it escapes from the abdominal ring, being in general felt unconnected with the swelling.

The testicle sometimes does not descend into the scrotum till late in life, and when in the act of doing so might be mistaken for hernia; but, in this case, no testicle is to be felt in the scrotum, and the tumor when pressed on produces a sickly pain.

## REDUCTION BY THE TAXIS.

Our first indication in the cure of herniæ, except in those which are very large, is to return the prolapsed parts into the abdomen, and the second indication is to retain them in that situation. The first of these indications is accomplished by the hand, which is called reduction by the taxis, and the second is effected by wearing a truss or bandage.

Many causes may be named besides strangulation, which may prevent the return of a hernia, but supposing the contents of the tumor capable of reduction, the first consideration is the best means of effecting it. There are three objects which the surgeon should have in view, when returning into the abdomen any protruded portion of the bowels, all of which are so obvious, that it requires no length of detail by way of illustration. The first is to place the patient in the position that will most effectually enlarge the opening through which the bowel is protruded. The second is to endeavour to lessen the bulk of the tumor before he attemps the reduction, and the third is to push up the contents in the direction in which they have descended. The first of these objects is best effected by laying the patient in the horizontal posture, the shoulders should then be raised and brought forwards, while the chest is turned obliquely to the opposite side. The thigh on the affected side should, at the same time, be bent towards the abdomen, and the knee turned in. This posture, by relaxing the abdominal muscles, as well as the fascia lata of the thigh, will give to the inguinal and femoral apertures, all the size they are capable of receiving. But while the surgeon endeavours to relax the opening through which the hernia protrudes, it is equally desirable to lessen the bulk of the tumor before he attempts its reduction, which we stated to be the second object he should have in view when reducing the hernia. Before he begins, therefore, to push it up, the hand should be applied to the tumor, and its whole surface equally and gently compressed. If it be an intestinal hernia, the pressure, by dislodging the flatus, or the fluid contents of the gut, will greatly lessen its size. Even if the prolapsed parts be omentum, the compression, by emptying the veins, will favour the reduction. While the hernia is thus gently compressed, the surgeon, to accomplish the third object, viz. the pushing up the contents of the tumor in the direction in which they had fallen down, should force the bubonocele up, by pushing in the course of the inguinal canal, upwards and outwards towards the ilium; and the femoral hernia, if small, first directly backwards and then upwards; but if the protrusion of the gut is so great that it has risen above the edge of Poupart's ligament, and is reflected upon the pubis, it should be first pushed downwards, as if along the thigh, to clear it of the ligament, and then backwards and upwards. In the reduction, the surgeon should always force in that portion which last protruded, and so on till the whole is reduced. The intestine commonly goes up suddenly with a guggling noise, but the omentum recedes slowly through the opening, and requires to be pushed up till the whole is reduced.

Hitherto, it must be remembered, we have been considering the hernia as not strangulated; and it will be remarked, that, in this case, if, in its reduction, it be of consequence to attend to the directions here given, it must be much more so when the protruded parts are inflamed, and there exist symptoms of strangulation.

## IRREDUCIBLE HERNIA, OR, THE CAUSES WHICH PREVENT REDUCTION.

When a rupture cannot be reduced on account of strangulation, there is immediate danger; but, independently of strangulation, a hernia may be irreducible from a variety of causes, and although none of these may be of such a nature as to be attended with present danger, still no patient can be deemed safe with an irreducible hernia. It is liable to become strangulated, by the descent of an additional portion of bowel, by a collection of fæces, or even by an accumulation of the natural secretions in the herniated portion of intestine, adding to the bulk of the tumor. A hernia becomes irreducible, chiefly from adhesions; from an increase of bulk in its contents, produced by a portion of omentum or mesentery becoming thickened and fleshy, or so loaded with fat that it cannot be forced through the opening by which it escaped; from the contraction of the abdominal muscles, which always takes place in proportion as the bowels are protruded, and which therefore prevails to a great extent in old and large herniæ; from the intestines being distended with air; and from the herniated intestine being loaded with feculent matter, or filled with indigestible substances.

It is sometimes extremely difficult to ascertain the exact causes which prevent the return of the bowels, but if the obstacle is judged to proceed from either of the two first we have enumerated, viz. adhesions or increased bulk of the omentum or mesentery, no attempt should be made to effect reduction, but the hernia should be supported by a well-padded suspensory bandage, to prevent a farther protrusion, and to defend from external injury that portion of the bowels which is already protruded. Although a great portion of the intestinal canal remains herniated, there is frequently no interruption to its functions, but no patient, in such circumstances, can be considered secure, as, upon any exertion, more of the bowels are liable to escape through the same opening and cause strangulation, by adding to the bulk of the tumor. Again, when the hernia is of very great size, its reduction is opposed by the contraction of the abdominal muscles, and consequent diminution of the cavity, but if reduction could be effected, the practice is not without danger, being apt to be followed by nausea, vomiting, and general inflammation of the belly. Petit relates a case, where the reduction was followed by nausea, vomiting, and other dangerous symptoms, the truss was removed, and every attempt made to reproduce the hernia, but without effect; peritoneal inflammation succeeded to the nausea and vomiting, and the patient died.* For this

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† Petit, Traité des Maladies Chirurgicales, tome 2d.

reason, in old and very large herniæ, we do not attempt reduction, but pursue the treatment recommended for ruptures irreducible from adhesions, or from an enlargement of the omentum or mesentery. But if the hernia is not of very great size, and is irreducible chiefly from the length of time the bowels have been protruded, and from the diminished capacity of the abdomen, arising from the contraction of the muscles, or from the increased size of the omentum or mesentery, as the reduction is the only security the patient has, it may in many cases be effected by confinement for several weeks to bed, conjoined with frequent purging, and a very spare diet. This treatment, by lessening the bulk of the protruded bowels, enables us to return a hernia, which, previously to its adoption, could not be forced into the abdomen. It was a frequent practice with Arnaud in ruptures of this description, and on many occasions had recourse to by Mr. Hey of Leeds in cases of large omental hernia. When the hernia is irreducible from the two last mentioned causes, viz. from the tympanitic state of the intestinal canal, and from the herniated intestine being loaded with feculent matter, or indigestible substances, which last, is the *hernia par engouement* of the French writers, the surgeon will, in general, by perseverance, effect the reduction. In the first of these cases, where the inflated state of the intestiues prevents the return of the bowels, the flatus may be dislodged by the repeated exhibition of purges, but more readily by cold saline clysters, the best of which is cold water, with an adequate proportion of the muriate of soda. By means of a large syringe, the cold injection should be thrown into the rectum and colon. As soon as it is received, the intestines contract, the flatus is expelled, and the bowels are so reduced in size as to permit of the easy return of the hernia. Even after operation, and where all stricture had been removed, I have seen the surgeon, from this distended state of the intestines, unable to reduce the gut till such time as the flatus was expelled by injection. In those cases where the reduction is opposed by fæces, or indigestible substances, collected in the protruded intestine, and which accumulation is a frequent occurrence in the herniæ of old men, the surgeon will often, by time, be enabled so to break down and mould the fæces to the size of the aperture through which the intestine protrudes, as to permit it to be returned. As in hernia of this description there is no great tendency to inflammation, repeated attempts may be made at reduction, provided they are done with circumspection; and as such accumulations depend upon a languid state of the bowels, a chief part of the treatment should consist in increasing their action, which is best done by repeated glysters of the decoction of senna, with a proportion of the sulphate of magnesia, or some other neutral salt, while at the same time cold water is repeatedly dashed about the abdomen and thighs. As all those herniæ, irreducible from accumulation, are liable to become inflamed and to terminate in strangulation, the surgeon should be unceasing in his efforts to procure reduction.

## RETENTION BY BANDAGE.

The proper construction and right application of a bandage form one of the most important parts of the treatment of hernia. Upon these depend not only the chance of a radical cure, but the safety of the patient. By improper pressure on the spermatic chord the testicle will inflame, or its structure may be destroyed; or if a portion of intestine slips from under the pad, the patient will be in greater danger of strangulation than if no truss were applied. The surgeon, instead of trusting to the truss-maker, should in all cases reduce the hernia himself, put on the bandage, and ascertain if it is accurately applied. This is of great consequence, as instances daily occur of inflammation and swelling of the testicle from pressure of the spermatic chord against the bone, or of the escape of the hernia under the pad, while the patient still continues to wear the bandage.

As much attention should be paid to the construction of the truss as to its application. It should always be elastic, with the spring made of steel, as no other can keep up a steady and equable pressure; and although the chief points of pressure are the groin and the sacrum, care should be taken that the spring be accurately adapted to the form of the pelvis, otherwise it will shift its place and the bandage be insecure. The strength of the spring must be suited not only to the nature of the hernia, but to the exertions of the individual: thus, when the hernia is small, and the patient a child, the spring should be weak, but strong and powerful when the hernia is large and the patient exposed to much exertion. Although the size of the pad should be in a great measure regulated by that of the hernia, still it should in all cases be considerably larger than the opening through which the protrusion has taken place. In fact, it should be of such a size as to lay the sides of the inguinal canal in contact, and cover both the external and internal openings; at the same time not too convex, but rather flat, that the pressure may extend equally over some surface. The pad should also be thicker at its lower part, gradually shelving away towards the upper, and by no means too hard, as, in this case, it would not only excite pain, but, by the firmness of its pressure, thin the abdominal parietes, and thus lessen the chance of a cure.* As the pad of the truss is in danger of being thrown upwards by the action of the thigh in walking, and thus permitting the hernia to escape, it should be kept down by a strap attached to the back part of the spring, then carried betwixt the patient's legs and fastened to the pad. This strap is in general required, and its use is indispensable in thin people, but in those who are fat the protuberance of the belly prevents it from rising, and confines it to its place.

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* The pad in general is made too convex and too hard. In constructing it, the compress should be made of cork, which is to be accurately adapted to the iron plate at the end of the spring, then covered first with three plies of flannel, and lastly with chamois leather.

The surgeon, when applying the bandage, should lay the patient on his back, and after having reduced the hernia in the manner we have directed, taking care that all the prolapsed parts are returned, he should place the pad so as to shut up the opening through which the bowels have protruded; and after having made fast the strap, he should make the patient get upon his feet, cough, and walk about the room, while he feels carefully whether any portion of bowel has slipped down behind the pad. If the hernia is retained, and if the patient has no pain, it is a proof of the proper adaptation of the truss; but if there is any great degree of pressure or pain about the spermatic chord, or if the hernia slips down behind the pad, it is wrong applied, or the truss is insecure. To insure the safety of the patient, and give a chance of a radical cure, the bandage should be worn during the night as well as the day; but if it is very uneasy in bed it may be removed, care being taken not to remove it at night before he lies down, and to re-apply it in the morning before he leaves the recumbent posture. By placing a piece of linen or cotton cloth under the cushion, the perspiration will be prevented from coming in contact with and hardening the leather; and it will be also found that the pad will sit easier, and not be near so apt to slip as when no compress is applied.

Independently of the constant application of the truss, the patient must refrain from over-exertions of all kinds, which are very apt to reproduce the hernia; they must therefore be cautiously avoided; and while we impress this on his mind, we should, at the same time, inculcate the necessity of regulating the action of the bowels by diet and laxatives.

## SYMPTOMS OF STRANGULATION.

When the rupture cannot be returned into the abdomen; when it is attended with pain; and when the course of the intestinal canal is obstructed, we say that the hernia is strangulated. The distress on some occasions is at first but slight, at other times great pain immediately follows the protrusion, and this is very apt to be the case when the hernia is suddenly produced; when the tumor is small; and when the patient is in the meridian of life. When the course of the canal is obstructed, unless the hernia can be reduced, the pain not only increases in the tumor, but extends over the abdomen; the signs of obstruction become more strongly marked, and symptoms of inflammation supervene. There is at first nausea and vomiting, and generally a corded feeling across the upper part of the abdomen; the rupture then becomes tense and swells, it is painful when pressed on; and the pain extends from the tumor over the whole belly, resembling cholic. Nothing can now effectually relieve the patient but the reduction of the hernia; and, when this cannot be accomplished, all the symptoms increase. There succeeds general restlessness; the pulse becomes quick, small, and hard; the vomiting is incessant; the pain over the belly is more violent, much increased on pressure, and accompanied with swelling.

When the strangulation has been of some continuance, or rather, when the disease is verging on to a fatal termination, the vomiting becomes stercoraceous, the surface of the tumor inflames, and the belly grows very tense, and is extremely painful, even when slightly touched, or when the patient coughs; the extremities become cold, and the pulse very quick and weak, accompanied by hickup and delirium, the contents of the tumor fall into gangrene, and the patient dies. Before death, the rupture sometimes recedes spontaneously, the intestine bursts, and the fæces are discharged into the abdomen. On other occasions, the pain in the tumor ceases, it loses its tenseness, and becomes of a dark colour; it feels soft and emphysematous, the parts slough, and the fæces are discharged; by which the relief is complete, and the patient often recovers. There is a considerable diversity with regard to the time that the strangulation subsists before it terminates in death. When the hernia is small, suddenly produced, and the patient young, mortification soon follows; whereas, if the hernia is large, and slowly formed, when it occurs in old age, and has become strangulated from accumulation, many days elapse before the fatal termination. During the whole progress of the case, the constipation is so complete, that after the lower part of the intestines has been evacuated, no discharge can be procured from the bowels situated above the herniated point, even by the most stimulating glysters.

Although the pulse in strangulated hernia in general soon becomes very quick and hard, yet this is not always the case; it has, therefore, been remarked, that the state of the pulse is no criterion of the condition of the protruded bowel. A portion of intestine may be completely strangulated without the pulse being increased in frequency, and, on some occasions, it has been observed to be even below the natural standard. I lately operated with success in a case of femoral hernia, where only the intestine was engaged. The tumor was small, very tense, and the intestine had been strangulated from Wednesday at mid-day till Saturday afternoon, it was of a dark red colour, and the stricture was so complete, that the probe point of the bistory could with difficulty be introduced. All the symptoms of strangulation were present, but there was little or no acceleration of the pulse.

Indeed, during the whole time of her recovery, the pulse never rose above eighty in a minute.

It is natural to conclude, that the symptoms which we have enumerated as indicative of strangulation, particularly the obstruction to the stools, will not present themselves, unless when the whole circle of the intestine is engaged in the stricture; but this is far from being the case, as the constipation is sometimes complete, and all the other symptoms present, when the intestine is not protruded in its whole circle, and even when the hernia is entirely omental. There may be another source of error with which it is right the young surgeon should be acquainted. A hernia is frequently irreducible from adhesions, although not strangulated; and a patient in this condition might be attacked with intususceptio, or with ilius, or have a stricture in the rectum, all of which produce the same train of symptoms as strangulated hernia. In this state of things, there is a danger of connecting the symptoms of obstruction and inflammation with the hernia, and proceeding to an operation which would afford no relief. If the pain in the abdomen does not stretch from the hernia, and if the tumor is free from tension, and has no pain on pressure, we may safely conclude that the symptoms are not dependent on the rupture, but arise from an affection of some other part of the intestinal canal.

## CAUSES OF STRANGULATION.

I BELIEVE it is now admitted by surgeons, that there is no such thing as the spasmodic strangulation of Richter. Upon reflection it will also appear evident, that there can be no contraction in the opening through which the hernia protrudes, as the aperture is situated in tendinous parts; and in bubonocele, with regard to the internal opening, although the bowel may be strangulated by the transversalis and internal oblique muscles, it is by the hernia passing under their lower edge, and not through their muscular fibres. The active causes of strangulation are, therefore, not referable to the opening through which the hernia descends, but to the contents of the tumor; in fact, the opening through which the hernia protrudes, instead of being contracted, must be more dilated, when the hernia is strangulated, than it was previously to the strangulation. When a portion of intestine is suddenly protruded, it inflames and swells, or it sometimes happens that, upon a sudden exertion, where a hernia already exists, a farther portion of omentum, or intestine, is forced out, which, by adding to the bulk of the tumor, is equivalent to a diminution of the opening. The thickening, which is formed in consequence of the inflammation, conjoined with the accumulated blood, and increased secretion, will add to the strangulation. In hernia which has been of some duration, the sac often gradually becomes thicker; and when this happens in its neck, it will first prevent the return of, and ultimately strangulate the hernia. The cause of strangulation is, therefore, often seated in the neck of the sac; and this seems to be particularly the case with congenital hernia. Scarpa is of opinion, that the cause of strangulation most frequently resides in the neck of the sac; and the fifteenth case of Mr. Hey's "Observations," is an instance where the neck of the sac produced the strangulation below the external abdominal ring. In many cases, after the tendon was divided, I have seen stricture continued by the neck of the sac. Constriction in the body of the sac may also produce strangulation; indeed, a hernia may become strangulated from a variety of causes; such as from the omentum being twisted round the intestine in the form of a ligature, from the intestine slipping through a fissure in the omentum, or from bands of adhesion; but the most common causes are increase in the bulk of the tumor, and thickening in the neck of the sac.

## MEANS RECOMMENDED TO BE TRIED BEFORE OPERATION.

When a hernia is strangulated and cannot be returned by the taxis, it is recommended by all systematic writers, before having recourse to operation, to try a variety of means, which are thought so far to change the condition of the parts as frequently to render the taxis successful; but I believe that, when a hernia is fairly strangulated, nothing will succeed but the division of the stricture; and I am sure that many a patient, who might have been saved by operation, has been lost by the delay necessarily incurred in the preparation of baths and exhibition of glysters.

The means which have been generally recommended to assist the taxis are blood-letting, the warm bath, cold applications to the tumor and to the surface of the body, and the tobacco glyster. I have enumerated them nearly in the order in which they are advised to be employed. I have tried them all myself, and have seen them tried on many occasions by others; but I cannot say that I ever saw any of them successful when the hernia was effectually strangulated, except the tobacco glyster. On a few occasions this remedy indeed seemed to succeed, and this by poisoning the system and placing the patient as it were in *articulo mortis*, a practice attended with the greatest danger.

BLEEDING.—When the hernia cannot be reduced by the taxis, the general practice is immediately to have recourse to blood-letting, with a view to induce fainting, and thus place the whole system in a state of relaxation; hence it is recommended to abstract the blood from a large orifice, and in an upright posture, and when the patient has become faint the taxis is to be tried. But as bleeding cannot widen the neck of the sack, and can have but little effect either in enlarging the aperture in the ring or in lessening the size of the contents of the hernia, it appears to me that it can be of little benefit in cases of strangulation. Blood-letting will no doubt retard the progress of the inflammation, but I am satisfied that it affords little assistance in the reduction.

Warm Bath.—The warm bath is recommended to be next tried as an auxiliary to the taxis, when blood-letting fails, and to be had recourse to as soon after the bleeding as possible, as they both tend to induce the same state of system. Although I have no doubt seen a surgeon return a rupture after a patient had been put into a warm bath who could not effect the reduction previous to the immersion, still I have considerable doubts as to the efficacy of the practice in cases of strangulated hernia; and if the surgeon has not been immediately called upon the commencement of the symptoms, this remedy should not be thought of, as much time will be lost in preparing it. The warm bath was at one time much employed in cases of strangulated hernia. This was when the prevailing doctrine ascribed the strangulation chiefly to spasm, but the practice seems to have fallen with the doctrine, and the warm bath is now seldom used by the best informed surgeons.

COLD APPLICATIONS.—It has been recommended to apply cold to the hernia, as by means of cloths dipped in cold water and vinegar, or in saline solutions, such as solutions of kitchen salt, or of nitre and the muriate of ammonia. Cold has also been employed by means of pounded ice contained in a bladder, and applied to the tumor.

As the internal temperature must remain always the same during life, to whatever degree of cold the body is exposed, any local application of cold can have little effect upon the contents of the hernia, and if great and long continued, there is danger of producing sloughing of the integuments. Cold applications must, therefore, be very useless or very dangerous remedies. The general and sudden application of cold, such as dashing pitchers of cold water over the abdomen and thighs, is much more likely to be of use; and we have the authority of Petit for saying, that, by this means, a hernia was suddenly reduced, which the surgeon had condemned to operation.*

TOBACCO GLYSTER.—The effects of tobacco upon the constitution are nausea, vomiting, vertigo, fainting, slowness of the pulse, and a universal depression of the powers of life; hence, it is frequently employed as an enema in strangulated hernia, and has succeeded when blood-letting, the warm bath, and cold applications, have all proved ineffectual. The glyster is prepared by boiling for eight or ten minutes one drachm of tobacco in a pound of water; and although it requires to be repeated till the system be brought under its influence, it must be administered with the greatest caution. Sir A. Cooper has seen the tobacco glyster prove fatal; this occurrence has also happened in the practice of other surgeons; and, I may remark, that, when it is unsuccessful, and the surgeon is compelled to have recourse to an operation, the tobacco glyster, by poisoning the system, certainly lessens the chance of the patient's recovery.

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* See Petit Traité Des Maladies Chirurgicales, tome ii.

In conjunction with the auxiliary means which I have now stated, the surgeon must have recourse to a prudent use of the taxis, placing the patient in the situation, and pushing up in the direction we have already recommended, taking care to use very gentle force, and not persisting in his attempts too long. By rough handling, not only will the inflammatory symptoms be increased, but, there is even danger of bursting the gut. Besides, by persisting too long in attempts to reduce the hernia by the taxis, or wasting time in other means, we lessen our chance of success from the operation. Indeed I have so little faith in any of the measures which I have mentioned as auxiliaries to the taxis, that I have for a long time past ceased to employ any of them. If the lower part of the bowels has not been unloaded by a purgative glyster before I have seen the patient, I order a strong decoction of senna, with one ounce of castor oil to be thrown into the rectum and colon, and when their contents have been evacuated, I try the taxis in the most gentle manner. If I do not succeed, I immediately have recourse to the operation with the knife. The less the tumor is handled, and the sooner the operation is performed, the greater the chance of recovery; and I think I am right when I say, that whenever the tumor feels hard, is painful to the touch, and cannot be reduced by the taxis, at the same time that there is a complete obstruction to the canal, an operation should be performed without delay.

## INGUINAL AND SCROTAL HERNIA.

The descent of the bowels through the inguinal canal, takes place oftener in the male than in the female, and is the species of hernia, which most frequently occurs. Sometimes the hernia enters only the internal ring, and does not appear at the external, sometimes it passes along the whole canal, and comes through the external opening, and at other times, the bowels do not enter the internal aperture, but protrude directly through the external. In either of these cases, the hernia may remain seated in the groin, or it may descend into the scrotum; and the tendency to this descent is so great, that on some occasions the tumor has reached to the knees. The penis is then so buried in the swelling as to be quite obliterated, and its place can be distinguished only by the end of the prepuce, which appears on the fore part of the tumor, in the form of a small loose ring. In ruptures through the inguinal canal, there is generally a hernial sac, but sometimes there is none; when there is, it is most commonly situated external to the tunica vaginalis, on some very rare occasions it has been found contained within it, and when the intestine or omentum has no sac, they are in immediate contact with the testicle. The hernia, in its descent through the inguinal canal, generally passes on the fore part of the spermatic chord, but occasionally it has been found to have descended behind it; and instances are not awanting where the chord has been split by the hernia, the blood vessels being before, while the vas deferens passed down behind, or *vice versa*. In the dissection of an old scrotal hernia, I saw the spermatic chord running on the fore part of the sac; and when we consider that the junction of the vas deferens with the other parts forming the spermatic chord, does not take place till where it enters the internal ring, we can easily conceive how the herniated bowel may sometimes split the chord. The coverings of the hernia, and the situation of the epigastric artery, are also different, according as the hernia enters the internal ring or protrudes directly at the external. But the course which the hernia takes in its descent, its coverings, and the relative situation of the epigastric artery, will be more easily understood by attending to the surgical anatomy of inguinal hernia, which is also the best guide in operation,

## SURGICAL ANATOMY OF INGUINAL HERNIA.

Much has been written of late on the anatomy of the parts engaged in hernia; but it appears to me that the subject has become more and more obscure, in proportion to the number of writers. This has arisen, chiefly from the multiplicity of names which have been given to the same parts, and from the rage which has prevailed for making discoveries, and manufacturing fascias, while in truth, not one of those distinct rings and fascias so minutely described by the anatomist, is to be recognised by the surgeon in the time of operation. I shall not descend to minute particulars, which overload the memory and obscure the subject, but proceed to state only the broad and general facts, or in other words, endeavour to give such a representation as, I conceive, will be of most use to the practical surgeon.

When the skin and cellular substance are turned off from the lower part of the side of the abdomen, and top of the thigh, a loose fascia or condensed cellular membrane comes into view. This fascia can be traced all along the sides of the abdomen, covering the external oblique muscle, and becoming stronger and more distinctly marked as it approaches the groin. It is attached to the whole extent of Poupart's ligament, and as it descends to cover the thigh, is so intimately interwoven with the lymphatic glands lying in the groin, that it cannot be separated from them; they must be raised together. This superficial fascia, as it is called, not only gives a covering to the abdominal muscles, and those of the thigh, but also encircles the penis, forms the suspensory ligament, and is spread out over the spermatic chord, and tunica vaginalis; hence every inguinal and crural hernia must be covered by the superficial fascia, as well as by the skin and cellular substance.

By removing the superficial fascia, the tendon of the external oblique muscle will be seen having its fibres running down in an oblique direction towards the pubis. This sheet of tendon is firmly attached to Poupart's ligament throughout. About an inch from the symphysis pubis the tendinous fibres split, to give passage to the spermatic chord in the male, and to the round ligament in the female. This opening is what has been called the abdominal ring. That portion of the tendinous expansion forming its upper edge is called the superior column, or pillar of the ring, and is implanted into the symphysis pubis; and the fibres forming its lower edge are called the inferior column or pillar of the ring, the external part of which runs forwards in a rounded form to be implanted into the tubercle of the pubis, while the internal part is flat, and runs horizontally to be inserted into the linea ileo-pectinea. By this construction the spermatic chord is lodged in a sort of groove, and protected from compression during the contraction of the abdominal muscles. The tendons forming the pillars of the ring at their upper part, or at that point farthest from the pubis, are tied together by transverse tendinous fibres, which greatly strengthen the opening; and a tendinous slip fixed to that part of the upper column of the ring connected with the pubis, passes down to be attached to the glutæus maximus and triceps muscles, adding still farther security to the opening.

I may here observe, that after the removal of the superficial fascia, before the pillars of the ring can be distinctly brought into view, it is necessary to dissect away a thin fascia which is seen coming off from the edges of the external ring, and which runs down upon the spermatic chord. This thin web has been called the fascia propria, and forms one of the coverings of the hernia. Behind the abdominal ring is situated the internal oblique and transversalis muscles, with the transversalis fascia, which close up the aperture, so that there is no direct opening into the abdomen.

If the tendon of the external oblique be separated from Poupart's ligament, nearly to the external ring, and turned upwards, the internal oblique muscle will be brought into view. This muscle is so closely connected with the transversalis situated under it that they are not easily separated in dissection. These two muscles will be seen departing from Poupart's ligament about two inches and a half from the pubis, and throughout this space the finger can be inserted under their lower edge. From this point of separation the tendons pass in an arched form behind the external ring, closing it up, and are implanted into the tubercle of the pubis and the linea ileo-pectinea. At the point where the internal oblique leaves Poupart's ligament a bundle of muscular fibres may be seen coming off, partly from the muscle and partly from the ligament. These fibres form the cremaster muscle, and pass down along the chord to suspend the testicle.

If the fleshy fibres of the lower edges of the internal oblique and transversalis muscles be now turned upwards, a thin delicate fascia, or rather a web of condensed cellular substance, will be discovered, attached to Poupart's ligament. This fascia runs upwards for four or five inches, lines the transversalis muscle, and is situated external to the peritoneum. It was first described by Sir A. Cooper, and called by him the Fascia Transversalis. It consists of two portions, an external and an internal; and while the external or iliac portion, by uniting with the fascia, covering the iliacus internus muscle, assists in shutting up the outer part of the crural arch, the internal or pubic portion passes down behind Poupart's ligament, and helps to form a sheath for the femoral vessels. The division betwixt the two portions of the fascia transversalis is about the middle of Poupart's ligament, or rather nearer to the pubis, and is covered by the oblique and transversalis muscles, except in the immediate vicinity of Poupart's ligament, where these muscles are not attached. This want of attachment in the muscles leaves an opening in the fascia transversalis which forms the internal ring, and which gives passage to the spermatic chord in the male, and the round ligament of the womb in the female. The internal ring is situated about an inch and a half nearer the anterior spinous process of the ilium than the external. The upper part of the opening is formed by the lower edges of the internal oblique and transversalis muscles, and the rest of the circle by the fascia transversalis.

The fascia transversalis prevents the bowels being protruded under the lower edges of the internal oblique and transversalis muscles, assists in closing up the external ring, and preventing a direct communication with the abdomen, and also forms the internal ring and a sheath for the femoral vessels.

The connexions of the fascia transversalis, and the manner in which it forms the internal ring, will be best seen by opening the abdomen and tearing off the peritoneum from the neighbourhood of the crural arch. To obtain this view, a transverse incision may be made through the parietes of the abdomen, commencing a little above the anterior superior spinous process of the ilium, and continued to the linea alba, and then another incision must be carried perpendicularly downwards from this point to the pubis. If the flap be now held up, and the peritoneum separated from the muscles in the neighbourhood of the crural arch, we shall have a distinct view of the manner in which the internal ring is formed by the separation of the iliac and pubic portions of the fascia transversalis. If the subject be a male, the vas deferens will be seen coming up from the pelvis; and the other parts of the spermatic chord, consisting chiefly of the blood vessels and nerve coming down from the loins, and uniting just before they pass into the internal ring. By a little dissection the external iliac artery will be brought into view, and the epigastric artery will be seen coming off from its inner side immediately above Poupart's ligament. This artery, in its course to reach the rectus muscle passes behind the spermatic chord, rises up at its inner edge, and consequently is situated on the pubic side of the internal ring. It then runs obliquely inwards and upwards on the outside of the peritoneum, and enters the posterior part of the sheath of the rectus muscle, about half way betwixt the pubis and the umbilicus.*

Inguinal hernia most commonly enters the internal ring before it protrudes at the external; but in consequence of malformation in the tendons of the internal oblique and fascia transversalis, of weakness or of laceration of these parts, the protrusion may take place directly through the external ring, and without having entered the internal. This species of hernia has been called direct or ventro-inguinal, while the descent by the internal aperture, is named oblique hernia. When we consider the situation of the epigastric artery, with reference to the internal ring, the distance betwixt the two openings, and the origin of the cremaster muscle, it will appear that where the hernia enters the internal opening, the epigastric artery will be situated on its pubic side, and that the sac will be covered by the cremaster muscle; whereas, when the protrusion is direct through the external ring, the epigastric artery will be on the iliac side of the hernia, which in that case will not be covered by the cremaster muscle. In the inguinal hernia of women, as there is no cremaster muscle, the coverings of the sac are consequently thinner.

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* For a view of the Surgical Anatomy of inguinal hernia, see plates 16, 17, and 18.

## OPERATION FOR STRANGULATED INGUINAL HERNIA.

We have described the course the hernia pursues in its descent through the inguinal canal, enumerated its various coverings, and represented the internal ring as situated about an inch and a half nearer the spinous process of the ilium, than the external; but in the operation for strangulated hernia the surgeon must not expect to meet with the distinct fascias and rings which are described by the anatomist. In no two operations will the parts be found precisely alike. The thickness of the coverings will depend on the size of the tumor, the duration of the hernia, the frequency of descent, the length of time the patient has worn a truss, and upon a variety of other circumstances; and if the hernia be large, the internal ring will be so close to the external, that the opening into the abdomen instead of being oblique will be direct. The healthy anatomy, therefore, is no sure guide to the surgeon during operation.

In performing the operation for strangulated inguinal hernia, the two chief points the surgeon has to attend to, are to conduct his incisions with such a degree of caution as to avoid wounding the intestine, and to divide the stricture by cutting in a direction so as not to endanger the epigastric artery. The patient must be laid either upon a table or a bed with his legs hanging over the fore part, the surgeon then kneeling or seating himself betwixt the patient's legs, commences his incision about an inch beyond the limits of the tumor, and carries it downwards through the skin and cellular substance, in the oblique direction of the spermatic chord. If the hernia is confined to the groin, or extends only a short way into the scrotum, the incision should be carried to its most depending part; but if the tumor descends to the bottom of the scrotum, the surgeon should not prolong his incision the whole length of the hernia, as there is not only no necessity of exposing so much of the intestines as the complete division of the sac would do, but there is also danger of opening the tunica vaginalis.

This first incision will divide the external pudic artery, which, if the tumor be large, or in a big man, will bleed so freely as to require to be secured by ligature. When the surgeon has divided the skin and cellular substance, he must proceed *in the* farther steps of his operation with the assistance of the dissecting forceps and a director, recollecting that neither the different fascias, nor the fibres of the cremaster muscle will come into view so distinctly as in the dissection of the dead body, *but* he will expose the hernial sac with great ease and safety, by lifting each successive layer of cellular membrane with the dissecting forceps, making a few slight scratches with the knife laid horizontally, and then introducing the director under the membrane, and dividing it by running the edge of the knife along the groove. In dividing the coverings of the hernial sac, the surgeon should always cut from the point of the director towards the handle. By this mode of procedure, there will be no danger of cutting more than he intended, and by drawing the fascia on the director, he will expose it to a fairer incision. When the peritoneal sac has been brought into view, the surgeon, in order to enable him to open it with safety, must lay hold of it, and raise it with the dissecting forceps in the same manner as in the previous steps of his operation, or he may pinch it up between the nails of his thumb and forefinger, and when held in this situation, by laying the knife horizontally, and cutting gently, he will open it without endangering e intestine. As soon as the sac is opened, a uantity of serum generally flows out; but I may mark, that serum is more apt to be collected in e sac when the hernia is large, and has been of ng continuance, than when it is small, and of a cent date. The surgeon should now introduce is director into the opening of the sac, and enlarge it by means of a probe-pointed bistory, till it will admit the finger. The finger is then to be passed in, and by carrying the bistory along it, the sac is to be divided upwards and downwards to such an extent as will enable him to examine its contents, and give sufficient freedom to divide the stricture. After the sac has been laid open, the surgeon should carry the point of the finger of his left hand towards its neck to feel for the stricture, but no violence should be used. After he has ascertained the situation of the stricture, he takes Weiss's concealed bistory, which is both a knife and director, and passes it along the finger, carrying the point of the instrument within the stricture, he then unsheaths the knife to a small extent, and by elevating its handle, the point resting on the finger, he divides the stricture directly upwards, inclining the incision neither towards the pubis nor the ilium. This incision should be made slowly; and as soon as the opening will admit the finger it should be introduced, to regulate any farther division that may be required, but no more parts should be cut than what is just sufficient to relieve the stricture; and the neck of the sac should always be divided along with the tendon, wherever the stricture is situated. By the division of the neck of the sac it inflames, and adheres more readily than when not cut; the intestine is not endangered in the reduction by forcing it through a narrow opening; and if the stricture is resident in this part, which is frequently the case, it must be divided to permit the return of the protruded bowels.

By cutting directly upwards, there will be no danger of wounding the epigastric artery, whether the hernia enters the internal ring or protrudes directly at the external opening. When it enters the internal ring, and follows the course of the chord, as the epigastric artery is then situated at the pubic side of the neck of the sac, if the incision in dividing the stricture be carried upwards and inwards, the artery will be divided; and if the hernia be direct, or a ventro-inguinal hernia, as the epigastric artery in this case is placed on the iliac side of the neck of the sac, if the surgeon cuts upwards and outwards, he will endanger this vessel; still the epigastric artery has been very seldom wounded in operating for strangulated inguinal hernia, notwithstanding the number of times the operation has been performed. Some writers indeed deny that the accident can happen, thinking that the artery must lie behind the neck of the sac, as it belongs to the under layer of muscles, but Scarpa, Mr. Hey, and others, have seen the artery wounded in operation, and even patients die from the hemorrhage.

When the stricture has been completely removed, the protruded parts, if not in a state of gangrene, should be immediately returned into the abdomen; and in doing this the thigh should be bent and the knee turned in, as in the reduction by the taxis. The mesentery should first be reduced, then that part of the intestine which is next the ring, or which last protruded, then the rest of the canal in succession, and last of all the omentum. If any adhesions exist betwixt the contents of the hernia and the sac, or betwixt the opposite sides of the intestine, they should be carefully broke down before reduction. This must be effected either by the finger or the knife; if the surgeon is compelled to use the knife, he must be cautious not to wound the intestine. When the intestine has been for some time under strangulation it always feels thick in its coats, and is of a dark red or purple colour; but this is no objection to its reduction, indeed, in all states, it should be returned, unless actually gangrened; even when the intestine has been wounded in operation, unless the wound is extensive, it should be reduced as the only means of safety. After the reduction has been effected, the finger should always be introduced into the abdomen, to ascertain that all source of stricture is removed; the integuments are then to be brought together by a few stitches of the interrupted suture supported by adhesive straps, soft compresses are to be applied, and the whole retained by a proper bandage. Mr. Pott and

Sir James Earle, in stitching up the wound, were in the practice of passing the first stitch close by the ring through the upper part of the sac as well as through the scrotum, but the lower stitches were carried only through the integuments. By carrying the first stitch through the sac close by the ring, the bowels were effectually prevented from again protruding during the cure. I have always been in the habit of passing the stitches through the integuments only, but I must confess that I have seen the bowels again protrude by the wound a few hours after the operation; and as the passing the first stitch through the sac close by the ring will effectually prevent this protrusion, I see no objection to the practice, as no harm can accrue from it, the ligature being passed through a portion of the peritoneum that is without the abdomen.

After the operation, great attention should be paid to the stomach and bowels; the sickness and vomiting must be allayed by means of effervescent draughts and aromatics, combined perhaps with small doses of opium, and the bowels must be kept free and clear, by glysters and gentle laxatives. If there takes place any diarrhœa, which is sometimes the case, it must be checked by the preparations of catechu and opium, but the most active part of our practice should be directed to obviate peritoneal inflammation; the patient must therefore be kept on a low diet; and if there is any tendency to inflammation, recourse must immediately be had to blood-letting, both general and local, to fomentations, the warm bath, blisters, sudorifics, and laxatives. If the patient recovers, he should not neglect to wear a truss, as he is still liable to the disease.

## DISEASED OR ADHERING OMENTUM.

After the sac has been opened, the stricture removed, and the first objects of the operation accomplished, it has, notwithstanding, been sometimes found that the whole, or part of the contents of the hernia, either have formed such adhesions as to prevent reduction, or are so diseased, that it would be dangerous to return them into the abdomen. The adhesions of the intestine can, in general, be broken down, but the omentum often adheres so firmly at the ring that it cannot be separated; from the effects of the stricture it is also sometimes in a suppurating or gangrenous state; and not unfrequently in old herniæ, where the omentum has been long protruded, it has lost its original character, and has degenerated into an enlarged and fleshy mass, so as to render it unsafe to be returned. In all these states, the adhering or diseased omentum may be safely cut off. Arnaud, and some other writers, recommend to put a ligature round the protruded omentum, then to cut off the diseased portion, and to return the sound into the abdomen, keeping the ligature without the wound, but in many cases where these directions have been followed, the result has been fatal. The irritation induced by the puckered and knotted omentum excites inflammation, which extends to the stomach, and sometimes overspreads the whole cavity, terminating in death. The fatal effects of surrounding the omentum with a ligature, and tying it *en masse*, are so well illustrated by two cases related by Mr. Lawrence, as well as by others detailed by Poutean, Pott, and Sabatier, that the dangers of the practice are now completely established. Wherever, therefore, it is necessary to remove a portion of omentum, the arteries should be secured individually by ligatures. If the omentum adheres at the ring, and cannot be reduced, all that portion which is exterior to it may be freely cut off, the bleeding arteries being secured. If any part of it has become knotted, hard, or fleshy, so that it would be unsafe to return it, the same practice is to be adopted, taking care to retain the ends of the ligatures without the wound; and when the omentum is in a state of gangrene, it must also be removed. In this case, if the surgeon cuts off the gangrenous portion nearly close to the line which marks the division between the living and dead parts, there will be little bleeding. Sharp was in the practice of cutting off the omentum, and returning it without a ligature, so was that great practical surgeon Mr. Pott; and Pipelet, in the eighth volume* of the Memoirs of the Royal Academy of Surgery, states that Caqué, in no less than nine cases, cut off the protruded portion of omentum, and returned the remainder without a ligature, and without the occurrence of any accident. I am therefore of opinion that, in general, no ligature will be required, although I must not conceal that two cases occurred to Mr. Hey,† where, after the reduction of the cut omentum, a profuse hemorrhage followed, which, in one of the cases, nearly proved fatal; and Sir E. Home was obliged, in one patient, to secure two arteries on the cut edge of the omentum, which bled profusely.

## MORTIFIED INTESTINE.

In consequence of the continuance of stricture the intestine frequently mortifies; and there are four states under which this may present itself in practice; 1st, It sometimes happens that where no operation has been performed, and without the integuments changing their colour, the tumor loses its tension and becomes soft, the pain entirely ceases, the intestine returns into the abdomen of its own accord, the patient passes his fæces, and dies in the course of a few hours; 2d, On other occasions, the contents of the tumor, the sac, and the integuments, are all involved in gangrene at the same time, the tumor loses its firmness, becomes of a dark-brown or blue colour, and feels emphesematous, the integuments slough, the intestine gives way, and the fæces are discharged with complete relief; 3d, It sometimes happens that there are no external appearances of gangrene, and that consequently an operation is performed; however, when the sac is laid open, it is found that, although the gut is not mortified to the extent of the protruded portion, or even in the whole of its circle, its texture is so far affected as to be gangrenous in one or two points; and 4th, On laying open the hernial sac, the vitality of the protruded intestine is sometimes found to be so entirely destroyed as to yield under the fingers.

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* 12mo edition, p. 455.

† Practical Observations in Surgery, 2d edition, p. 188.

The first of the cases which we have now enumerated is not an object for treatment. It matters little what is done for it, as no practice that can be devised will save the life of the patient. In the second case, where the integuments, sac, and intestine fall into gangrene at one time, the patient often recovers, having an artificial anus at the groin. The bursting of the intestine, and the discharge of the fæces, are followed with the same relief as the removal of the stricture. The same process which destroyed the strangulated portion of gut makes that part of the intestine which is in contact with the ring adhere at this point to the peritoneum, and the fæces are discharged by the wound. The treatment consists in securing a free outlet for the fæces, and in fomenting and poulticing till all the sphacelated portion sloughs off. Sometimes the fæces continue to be discharged by this artificial opening during life, but frequently after a time they begin to be discharged by the anus, the wound heals up, and the continuity of the canal is restored. In the third case, where, upon opening the sac, the intestine is found to be gangrenous only in part of its circle, or where there is a spot of mortification, the stricture should be divided, and the bowel reduced in the same manner as if it were sound. There is no necessity for securing it by stitches to the external wound, as it is already fixed by adhesion to the peritoneum. It is now an ascertained fact, that the intestine cannot retire, and that as soon as the mortified sloughs separate, the fæces will be discharged by the wound. As the sphacelated portion is small, and does not involve the whole diameter of the gut, this species of artificial anus is in general cured, the feculent discharge gradually lessens, the fæces resume their usual course, and the wound heals up. In the fourth and last case, where, after operation, the vitality of the whole protruded portion of intestine is found to be destroyed, it must be recollected that the previous inflammation has fixed the intestine to the peritoneum in the vicinity of the stricture, so that it cannot withdraw itself from the ring; all that the surgeon, therefore, has to do in such a case, is to make a free opening in the gut so as to discharge its contents, to leave the stricture untouched, to foment and apply poultices, and then for the time to intrust the rest to nature. The practice recommended by Dupuytren, is to make an opening into the intestine, but not to touch the stricture; while Lawrence and Breschet, independently of making this opening, recommend to divide the stricture. There seems to be no necessity for dividing the stricture, if there is a free outlet for the fæces, besides, by doing so, we in part destroy the adhesions which secure the intestine to the ring; but if the opening for the fæces is not so large as to afford complete relief, it will be advisable to dilate the stricture to such an extent as to permit a free evacuation. There are many cases on record where large portions of the alimentary canal are said to have sloughed off, and the patients to have survived. Arnaud states a case where no less than seven feet of the ilium and colon were cut away, and yet the patient recovered with an artificial anus at the groin.* The chances of the fæces resuming their natural course, and the opening in the groin healing up, are less than when the intestine is gangrenous only in a part of its circle; but if the opening be in the large intestines, or in the lower part of the ilium, as there is then no deficiency of nourishment, the general health will not be affected.

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* Arnaud on Hernias, p. 341, et seq.

## CRURAL HERNIA.

FROM its situation, crural hernia is difficult to be retained by bandage, and from the smallness of the opening through which it protrudes, and the acuteness of the angle which it forms when reflected upon the pubis, it is much more liable to become strangulated, and more difficult to be reduced than any other species of hernia. It was not till early in the last century it was discovered that the bowels sometimes descended under Poupart's ligament, and that a distinction was made betwixt crural and inguinal hernia; and it is only of late years that the parts which most commonly form the stricture in this species of the disease have been pointed out. From the connexions and resistance of the fascia, crural hernia never attains the size of that which descends through the inguinal canal; and although the disease sometimes occurs in the male, its existence is much more frequent in the female, because, from the form of the pelvis, the opening which permits the lymphatics of the thigh to pass into the abdomen, and through which the bowel descends, is larger in women than in men. The true nature of the disease, the seat of the stricture, and the parts which require to be cut in operation, will be best understood by attending to the anatomy of the crural arch.

## SURGICAL ANATOMY OF CRURAL HERNIA.

In the description of the anatomy of inguinal hernia, we remarked, that when the skin and cellular substance were removed from the groin, a superficial fascia came into view; that this fascia was attached to Poupart's ligament; that it descended upon the thigh, where it was so intimately interwoven with the inguinal glands that it could not be easily separated from them; and that it gave a covering both to inguinal and crural hernia. If this superficial fascia be raised from the external oblique muscle down to its attachment to Poupart's ligament, and the pubic portion of it be then separated from the ligament and from the pubic portion of the fascia lata at the upper and inner part of the thigh, which is easily done by the handle of the knife, while its attachment to the iliac portion of Poupart's ligament and to the symphysis pubis is allowed to remain, a cavity or pouch will be formed, which contains the sac of the crural hernia. If the finger be carried a little way down the thigh to the bottom of this pouch, it will meet with so strong a resistance that it cannot be passed any farther in that direction. This arises from the firm connexion of the superficial fascia with the inguinal glands, and effectually prevents a crural hernia descending along the thigh. The opening through which the hernia protrudes, the cellular substance and lymphatic glands lying at its entrance, and the crescentic form of the iliac portion of the fascia lata can now be felt with the finger, but they are best seen in a farther stage of the dissection.

Upon removing the fascia superficialis, Poupart's ligament and the fascia lata of the thigh will be brought into view. At the upper and inner part of the thigh, over the pectinalis and triceps muscles, will be seen a distinct hollow, of an elliptical form. In this hollow is lodged some cellular substance with lymphatic glands, while the saphena major vein is seen passing in to enter the deep femoral vein, and the upper and outer edge is surrounded by a well-defined margin of the fascia lata, of a crescentic form, which, from its resemblance to a sickle, has been called by Mr. John Burns of Glasgow, the falciform process of the fascia lata. The fascia lata has been described as consisting of two portions, an iliac and a pubic portion. The iliac portion is stronger than the pubic, and is attached to rather more than two-thirds of the outer part of Poupart's ligament; it covers the muscles on the upper and outer part of the thigh, and also the femoral vessels, and its crescentic edge looks towards the pubis; while the pubic portion is attached to the remaining third of Poupart's ligament, and is thinner than the iliac; it covers a part of the pectinalis and triceps muscles, and passes behind the vena saphena major, to be connected with the iliac portion. Although the iliac and pubic portions of the fascia lata be apparently separated at the top of the thigh, from the circumstance of their lying upon a different level, and from the opening, for the entrance of the saphena vein, yet below the hollow we have already mentioned they are in close connexion, and form one continuous surface.

The greater part of the space under the crural arch is filled up by muscles and the vessels of the thigh; and the junction and connexions of the iliac fascia, the fascia transversalis, and the fascia lata, with Poupart's ligament, prevent the protrusion of the bowels at this place. However, at the upper and inner part of the hollow, which is seen upon the removal of the fascia superficialis, there is an opening which permits the lymphatics to pass into the abdomen. This opening is filled up only by cellular substance, which, when the lymphatics are torn away, has the appearance as if perforated with holes, hence it has been called the cribriform fascia. The opening is situate betwixt the femoral vein and the pubis, and is called the crural aperture, or ring. It is through this aperture that the hernia descends, forcing the cellular substance, and sometimes carrying before it, a gland which lies in the inner part of the opening.

Before we can fully understand the opening through which the hernia descends, or acquire a right conception of the parts which form the stricture, it is necessary to examine the crural ring from the inside of the pelvis. If the abdomen be opened, the flaps turned back, and the peritoneum separated from the neighbourhood of the crural arch, a cavity or hollow will be perceived betwixt the iliac vein and the pubis. This cavity is larger in women than in men, and contains a quantity of cellular substance, and sometimes a lymphatic gland. If part of the cellular substance be cleared away, the iliac vein will be seen on the iliac side of the opening; and on the pubic side the insertion of the tendons of the obliquus internus, and transversalis muscles; and if these tendons be removed, the inner margin of the crural aperture will be found to be formed by a ligamentous substance of a crescentic shape. This is what has been called Gimbernat's ligament, which is just Poupart's ligament becoming broad, and of a circular form, where it is implanted into the crista of the pubis. If the finger be passed from the inside of the abdomen into the crural aperture, and pushed forwards, the cellular substance filling it up, will be carried before the finger, which will at last appear externally. In this course the edge of Gimbernat's ligament will be first felt towards the pubis, sharp, and of a crescentic form; by pushing the finger a little farther on, the falciform process of the fascia lata will be distinctly perceived on the outer margin next the ilium, and if the finger be directed upwards, Poupart's ligament will be felt. From Gimbernat's ligament, Poupart's ligament, and the falciform process of the fascia lata being all connected together, they form a part of one circle; and, by bending the thigh and turning in the knee, this circle will be relaxed, and the size of the crural aperture increased. This is the position therefore, in which the limb should be placed when we attempt the reduction of crural hernia, either before or during operation. Although the stricture in crural hernia may be situated in the neck of the sac, it is more commonly resident in the opening through which the hernia protrudes; and it may be either produced by Gimbernat's ligament, or the falciform process of the fascia lata; but the prevailing opinion is that the seat of stricture is most commonly in Gimbernat's ligament. In whichever of these two parts the stricture resides, the division of either of them, to a certain extent, would relieve it, as they both form a part of the same circle, but an incision to a less extent will be required the nearer the surgeon cuts to the pubis. This was a practical observation of Professor Richter, and of Mr. Hey, long before they were acquainted with the anatomy of the part which caused the strangulation.

From the examination of the crural arch, we perceive that the hernia must always descend through the crural ring; that, at its entrance, the iliac vein is situated on its iliac side, and Gimbernat's ligament on the pubic side; that when the hernia appears on the fore part of the thigh, Poupart's ligament is placed directly above it, and the falciform process of the fascia lata on the upper and outer part of the neck of the sac. As the hernia descends, it passes into that oval depression which we have already remarked at the top of the thigh, and in its descent, when it comes in contact with the connexion of the superficial fascia and lymphatic glands, as it is prevented from passing farther in that direction, it separates the superficial fascia from the pubic portion of Poupart's ligament, and is then reflected upon the pubis occupying the situation of bubonocele. It is thus evident that the body of the sac in crural hernia lies on the outside of the fascia lata, its neck under the falciform process of that membrane, and that the whole is covered by the superficial fascia.

The epigastric artery lies on the iliac side of the crural aperture, and is not endangered in operation unless the surgeon carries his incision upwards and outwards. The spermatic chord is also safe, from its distance; but the obturator artery when it is sent off by the epigastric, which is frequently the case, might be wounded in the division of the stricture. The obturator artery is also sometimes sent off by the external iliac. When it comes off from the external iliac, or from the epigastric close by its origin, it will be situated behind the neck of the sac and in safety; but if it arises at some distance from the origin of the epigastric, perhaps an inch, it will pass over the anterior part of the neck of the sac in its course to get into the pelvis, and will be then in danger if the stricture is divided directly upwards.*

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* As no words can convey an accurate idea of the anatomy of the parts engaged in hernia, the reader is referred to the plates.

## OPERATION FOR STRANGULATED CRURAL HERNIA.

In the operation for crural hernia, the surgeon must proceed with the same degree of caution which we have inculcated in operating for inguinal hernia. This is more especially necessary, as in this case the coverings are thinner, and there is generally less fluid in the sac. In performing it, the surgeon and patient are to be placed as when operating for inguinal hernia. The external incision should be commenced about an inch above the tumor, pass over its centre, and terminate about half an inch below its base. By this extent of incision, the contents of the sac will be brought more distinctly into view, and more freedom will be given for the division of the stricture, which is situated deep. It is preferable to make the external incision somewhat in an oblique direction, as by so doing the sac and its contents will be more freely exposed, and its direction may be either from above downwards and outwards, or downwards and inwards. If the external incision be free, there will in general be no necessity for cutting the integuments transversely; and the flaps should on no account be dissected back, as their being so would prove more unfavourable for adhesion.

Some surgeons make the external incision by pinching up the integuments over the centre of the tumor betwixt the finger and thumb, and, while they hold them in this situation, aided by assistants, they make an incision through the fold that is raised. When the integuments are let loose, a great part of the external incision will be found to be accomplished, and it is easily prolonged upwards and downwards so as to extend somewhat beyond the limits of the tumor. If any branches of the external pudic artery are divided, they should be secured by ligature before proceeding farther in the operation. This is the most expeditious and easiest way of making the external incision. The surgeon must now proceed to expose the sac, which he does by dividing the successive fasciæ or condensed layers of cellular membrane, as recommended in operating for inguinal hernia. This, we have already observed, is best and most safely done by pinching up a small portion with the dissecting forceps, and cautiously scratching, with the knife laid horizontally, till a small opening is made into which he introduces the director; when, by cutting along its groove, he divides the membrane from the top to the bottom of the wound. By proceeding in this manner with the successive coverings, the sac will be safely brought into view. Some embarrassment is apt to arise in the operation when the hernia is small, from the sac being sometimes covered by a lymphatic gland, which has been projected before the hernia, and which so completely obscures it, that he cannot distinguish the sac. But the mistake which the young surgeon is most apt to commit, is his taking the sac for the intestine. I have seen this occurrence repeatedly; and, from the thinness of the sac, this mistake is more likely to happen in operating for crural than for inguinal hernia. If there is no fluid in the sac, the surgeon is in danger of cutting into the intestine; and when the sac is thin, if he mistakes it for the gut, it remains unopened. He enlarges the crural aperture, and imagining he has opened the sac, as well as relieved the stricture, he pushes the sac up with the intestine. If the hernia is small, and the adhesion slight, this is so easily effected, that he never doubts that the gut only is reduced. In this case, if the stricture be situate in the neck of the sac, the strangulation continues, and the patient dies unrelieved. The possibility of mistaking the sac for the protruded bowel, should be kept well in view, as it may be followed by fatal consequences. Let it be remembered that the sac is not so smooth, that it wants the figured form, and that it is not of so dark a colour as a portion of strangulated intestine. There is little danger of mistaking the omentum for the sac, as the former can always be unfolded and spread out. When the sac has been exposed, as it is in general much thinner than that of the bubonocele, and as it seldom contains much fluid, it must be opened with great caution. This is safely done by pinching up a part of the sac either with the dissecting forceps, or betwixt the finger and thumb, and then cutting it by scratching with the knife laid horizontally. By the introduction of a director and a probe-pointed bistory, the opening is to be enlarged till it admits the finger, which being introduced, the sac is to be laid open its whole length. In crural hernia, the stricture is always so close as to preclude the introduction of the point of the finger, but at the upper and inner part of the wound, the surgeon should insert his finger nail, and, guided by it, introduce Weiss's knife sheathed. No more of the knife should be introduced into the abdomen than its probe point. It should be passed close to the crista of the pubis, and the knife then unsheathed to no farther extent than just to present a cutting edge. With the knife close to the pubis, and with its cutting edge directed obliquely inwards and upwards, the surgeon employing a sawing motion, will feel the stricture give way like the tearing of a piece of parchment. No more of the ligament should be cut than what is just sufficient to relieve the stricture; and if the surgeon cuts close by the pubis, it is astonishing how small an incision will be required. Where the stricture was so close, as barely to admit the point of Weiss's knife, I have, by using the slightest sawing motion with the hand, felt the ligament instantly give way to such an extent, as permitted me to return with ease the protruded intestine. If the surgeon carries his incision upwards and outwards he endangers the epigastric artery, if he makes it directly upwards in the male, the spermatic chord is in danger, or if the obturator artery surrounds the neck of the sac, it may be divided; but if he use Weiss's knife, turning its edge obliquely inwards and upwards, close by the pubis, in the manner now directed, by a small exposure of the edge, and by sawing rather than cutting, the stricture will be safely removed, and the obturator artery will run little risk of being divided, even if it pass round the neck of the sac.

After the stricture has been removed, in the reduction of the bowel, in the management of the intestine and omentum, and in the after-treatment, the surgeon should proceed as after the operation for inguinal and scrotal hernia.

## UMBILICAL HERNIA.

Umbilical hernia in children is small, but in the adult, when it has been of long continuance, it often acquires a great bulk. The omentum in these cases commonly forms a large portion of the contents of the sac, and frequently adheres to it. In this species of hernia, the patient is very subject to cholic, but the opening is in general so free that it is seldom the subject of operation. I have never needed to operate on account of strangulation in umbilical hernia, neither have I ever seen the operation performed but once, and the patient died. We have already remarked, that the subjects most liable to protrusion of the bowels at the umbilicus, are children, pregnant women, and those labouring under ascites. The disease is always curable in infancy, as there is a natural tendency in the umbilicus to contract; but in the adult it is incurable, and requires to be retained by bandage. In infancy it may be cured, either by ligature or by compression. The ligature was the method adopted by the older surgeons. Saviard in 1694 succeeded in the cure, by ligature, on a goldsmith's daughter, fourteen years of age;* but Desault, who revived the ligature after it had fallen into disuse, failed to effect a permanent cure in a patient nine years old; he therefore restricts the use of the ligature to the period of infancy.

When the method of cure by ligature is resorted to, the hernia must first be reduced, a ligature is then put round the base of the sac, and pulled so tight as to cause a degree of pain. The tumor in two or three days shrinks, when the ligature becomes loose; another should then be applied, and in two days more repeated if necessary. In eight or ten days the gangrened parts drop off, leaving an ulcer, which soon heals, and the bowels remain within the abdomen. To prevent the cicatrix being forced, and the reappearance of the hernia, it will be necessary for some time to support the umbilicus by a compress and bandage.

In the cure by compression, all that is required, is to retain the protruding intestine within the abdomen, so as to favour the natural tendency which the umbilicus has to contract. This is best effected by graduated circles of adhesive plaster, which was recommended many years ago for the retention of hernia, by Dr. Monro Secundus. After the hernia has been reduced, a circular piece of plaster, a little larger than the umbilicus, should be applied, then another circular piece somewhat larger than that, and so on in a graduated series till seven or eight pieces have been employed. The whole should then be retained, and a moderate pressure kept up by an easy elastic bandage.

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* Saviard's Observations in Surgery, p. 22.

The method of treatment by compression, is attended neither with pain nor danger, and, if properly applied, is always effectual; I therefore conceive it to be the preferable method of cure.

## SURGICAL ANATOMY OF THE UMBILICUS.

The surgical anatomy of the umbilicus is extremely simple, and may be described in a few words. By the union of the tendons of the external oblique abdominal muscles, a strong white tendinous line is formed, running from the ensiform cartilage to the pubis, called the linea alba. In the centre of this tendon is the umbilicus, which, in the fœtus, gives passage to the vessels of the chord, but, which in the adult, is filled up with cellular substance, and with the umbilical vessels, degenerated into a ligament. On the inner surface of the umbilicus, the peritoneum is entire.

The vessels of the chord do not perforate this membrane on entering the abdomen, but pass betwixt it and the muscles. Every umbilical hernia therefore has a peritoneal sac, as well as the hernia of the inguinal canal or crural arch. The umbilicus, after birth, has a natural tendency to contract, and becomes firm, if the contraction is not opposed by the protrusion of any of the abdominal contents; but, in after life, the opening is liable to be enlarged by the distention of the abdomen, as in ascites or pregnancy. From the direct course of the opening, the umbilicus is less protected than the inguinal ring, although hernia does not occur at this place nearly so often as at the groin, because it is not so much acted upon in the erect posture, by the diaphragm and abdominal muscles in the common exertions of the body.

## OPERATION FOR STRANGULATED UMBILICAL HERNIA.

When the umbilical hernia becomes strangulated, the strangulation is caused by the edge of the tendinous ring of the linea alba, the opening requires therefore to be enlarged to remove the stricture. When the hernia is large, it will not be advisable to open the sac, or at least not to its whole extent, otherwise, by exposing much of the bowels, we endanger peritoneal inflammation. As the coverings here are always thin, the operation must be proceeded in with great caution. The patient should be placed in the horizontal posture, and if the tumor is of a moderate size, a longitudinal incision should be made in its whole extent, and so as to pass through its centre. In making this incision, the surgeon must be careful not to injure the contents of the hernia, as the sac is sometimes very thin, and on some occasions even absorbed. When the sac has been exposed, a small opening is to be made into it, by raising it with the dissecting forceps, and scratching with the knife laid horizontally. The fluid then escapes, and into this opening a director is to be inserted, and by a probe-pointed bistory the wound is to be enlarged till it freely admits the finger. The operator then introduces the forefinger of his left hand, and by carrying the bistory along it, enlarges the opening in the sac. This allows him to carry his finger to the umbilical ring, which he may divide either upwards or downwards to such an extent as will permit the return of the protruded bowels. To prevent him wounding the intestine, the surgeon, in cutting the tendon, should exchange the naked bistory for the sheathed knife of Weiss, which he should pass along his finger, inserting its point into the ring, while, with the same finger, he presses back the intestine.

In the management of the omentum and intestine, whether they adhere or are gangrenous, the same treatment is to be pursued, as recommended after the operation for inguinal hernia.

As Hernia, when under strangulation, is a very dangerous disease, and the young surgeon requires every assistance to guide his judgment, and to give him confidence in operating, I beg leave, before I conclude this subject, to direct his attention to a few practical points. 1*st,* That he should have recourse to operation early, and not lose time in the trial of those means which have been recommended in aid of the taxis. 2*dly,* That, after the division of the skin, he will expose the hernial sac without difficulty or danger, by inserting, successively under each of the layers which form its coverings, a director, along the groove of which he is to cut. 3*dly,* That, in removing the strangulation, he should, in order to avoid injury to the intestine, or the danger of hemorrhage, employ a concealed knife, such as Weiss's, and cut to no greater extent than what is just sufficient to relieve the stricture; and, 4*thly,* That he should bear in mind the possibility of mistaking the sac for the intestine, and, therefore, attend carefully to the marks which we have given for distinguishing them.

# CHAPTER XXI.

## DISEASES OF THE PELVIC VISCERA.

### GENERAL REMARKS ON THE STRUCTURE OF THE PELVIC VISCERA.

The Pelvic Viscera are the urinary bladder and the rectum in the male, and these, with the uterus, in the female. The diseases of the two former only, I mean at present to consider, reserving the affections of the last, till we come to treat of the diseases of the parts of generation in the female.

To enable the surgeon to perform his operations on the bladder and rectum with dexterity and safety, it is necessary that he should rightly comprehend the inflections of the peritoneum in the pelvis, and the manner in which this membrane covers the bladder and rectum; that he should be well acquainted with the course of the urethra, and fully understand those muscles which are situated in the perinæum; the connections of the levator ani, which covers in the lower part of the pelvis, and the course of the internal pudic artery, with its more important branches.

1st, We have not now to consider the peritoneum as a membrane, lining the abdominal muscles, giving a covering to the viscera, and forming those various ligaments which support and retain them in their place; but to reflect upon the manner in which it covers the pelvic viscera, forming a sort of septum betwixt the abdomen and the lower part of the pelvis. The peritoneum covers a great part of the rectum, but does not descend to the anus. Nearly opposite to the upper part of the vesiculæ seminales it passes off from this gut, and is reflected upon the posterior surface and sides of the bladder, leaving in the distended state of this viscus about three inches of the rectum uncovered. This membrane then ascends, covers the fundus and a portion of the forepart of the bladder, and again turns off to the anterior walls of the abdomen, where it is continuous with the abdominal peritoneum. By this construction, it is evident the rectum may be divided nearly to the length of the finger above the anus; the bladder may be cut into on the posterior part of its neck, directly behind the prostate gland; and it may also be opened, when distended, immediately above the pubis, without entering the abdomen. It is necessary to recollect, that in proportion as the bladder becomes distended the space uncovered by peritoneum will be increased.

In the female, the uterus and vagina are interposed betwixt the rectum and the bladder, and the peritoneum is reflected from the rectum upon the upper part of the vagina. It also covers the whole posterior part of the uterus; and its fundus then passes down upon its anterior surface, and is reflected from the upper part of the vagina upon the bladder, so that the whole of the uterus and upper part of the vagina are covered by the peritoneum.

2d, In the lower groove of the corpora cavernosa penis, is situated the urethra, leading from the point of the glans to the bladder. This canal in the adult is about nine inches in length, seven inches from its orifice to the bulb, which lies a little above the anus, one inch and a half in its membranous part, and half an inch through the prostate gland. It is capable of great dilatation in the living body, and in the dead is much wider than what is generally imagined. From the orifice to the bulb the urethra runs in a straight line, is the only part of the canal that is external or without the body, and is surrounded by the corpus spongiosum. The membrane of the urethra is very delicate, and if the catheter or bougie be forced through its walls at any part anterior to the bulb, there will take place an effusion of blood. The arch of the pubis is filled up by a triangular ligament, upon this ligament the bulb rests, and a little beyond this point, the urethra passes through a hole in the ligament to enter the pelvis in its passage to the bladder. This gives a new direction to the course of the canal, and constitutes the chief difficulty in the introduction of the catheter. From the bulb to the prostate gland the urethra is not covered by any cavernous or spongy body, but is quite unsupported, and hence is called the membranous part of the urethra. It lies entirely within the pelvis, and can be felt only from the rectum. This part of the canal has so little support that the catheter is easily forced through it; but the accident is not so readily followed by effusion of blood, because the instrument does not pass into a spongy substance like the corpus spongiosum, but into the loose cellular membrane betwixt the rectum and bladder.

The mucus of the urethra, which is in considerable quantity, and which defends it from the acrimony of the urine, is secreted by lacunæ or mucous follicules; their mouths look towards the orifice of the urethra, and there are two of them of such a size as will catch the point of a small catheter or bougie, in its passage into the bladder. The first of these is situated about an inch from the orifice on the upper part of the canal, and the other is near the neck of the bladder, a little before the verumontanum. This last is particularly apt to arrest the point of the catheter, a circumstance which should be kept in view, for if the instrument be pushed on, it will make a false passage.

itself with the scrotum. When the urethra ulcerates in stricture, or bursts from an injury, and the urine escapes, this fascia prevents it reaching the surface in the perinæum, it therefore passes forwards amongst the loose cellular substance in the scrotum, where it generally induces inflammation, which terminates in gangrene. To prevent this occurrence, the surgeon, as soon as he ascertains that the urine has escaped from the urethra, should, to permit of its free discharge, make a deep incision through the fascia.

If the perinæal fascia be raised, and the cellular substance removed from the hollow betwixt the tuberosity of the ischium and the anus, and from the rounded part of the hip, the muscles connected with the penis and anus will be fully displayed. 1*st*, There will be seen the acceleratores urinæ with their oblique fibres covering the bulb and a part of the corpus spongiosum, and meeting in the centre, so as to form a distinct tendinous line. 2*d*, The erectores penis arising from the tuberosity of the ischium, twisting round the ramus of the bone, and running on to be expanded on the crura penis. 3*d*, The transversales perinæi lying deep, and passing obliquely across the perinæum from the tuberosity of the ischium to the bulb. 4*th*, The sphincter ani encircling the extremity of the rectum; and, 5*th*, The levator ani coming down in the form of a funnel from within the pelvis, surrounding the rectum, and mixing its fibres with the sphincter ani. All these muscles, with the exception of the erector penis, meet and form a tendinous connection at the bulb. In this dissection, the large fibres of the glutæus maximus will also be perceived upon the rounded part of the hip, and the arteria transversalis perinæi, an important branch of the internal pudic, will be seen rising up from under the transversalis perinæi muscle, and crossing the perinæum in the same direction; while the branch called superficialis perinæi will be observed running betwixt the accelerator and erector muscles.

To obtain a deeper and more comprehensive view, the acceleratores urinæ and the transversales perinæi must be removed, when the corpus spongiosum, and its termination the bulb, will be distinctly seen as well as the triangular ligament which fills up the arch of the pubis, and through which the commencement of the membranous part of the urethra passes. The arteries of the bulb will also be seen entering its spongy substance, and the trunk of the internal pudic artery, from which they arise, may be traced running up on the inner edge of the ramus ischii towards the root of the penis. If the levator ani be now slit up, the membranous part of the urethra will be seen passing through it, and by a little dissection the prostate gland will be brought into view. The vesiculæ seminales, lying behind the gland, diverging from each other like the legs of the letter V, may be also seen; and if the bladder be now inflated, a distinct conception of the relation which the several parts bear to each other will be obtained.

As no description can convey a correct idea of the relative anatomy of the perinæum, and of the contents of the pelvis; and as this knowledge is of the first importance to the operating surgeon, I have given two drawings, one of the muscles of the perinæum, and another of a section of the pelvis, showing the course of the urethra, with the relative positions and connections of the contained parts. It must be remembered, however, that no drawings can supply the place of dissection, the frequent practice of which is essential to form the safe operator.

## SECTION I.

### DISEASES OF THE BLADDER.

The urinary bladder is subject to a multiplicity of diseases, such as inflammation, thickening of its coats, ulceration, tumors, inability to expel the urine, and calculous concretions. Many of the diseases of this viscus are incurable; and all of them are attended with extreme pain, arising chiefly from the contraction of the bladder in the expulsion of the urine. The diseases which we have now to consider are retention of urine and stone in the bladder, as being the two which call for operation.

## RETENTION OF URINE.

In proportion as the urine accumulates, the bladder rises above the pubis, and when immoderately distended, can be felt in that situation forming an elastic circumscribed tumor, excessively painful when pressed on. While the tumid bladder rises above the pubis, it, at the same time, presses backwards so as to fill the pelvis; and if the fingers be introduced into the rectum, it can be felt round, like a child's head, occupying the hollow of the sacrum. The desire to pass the urine returns at short intervals, accompanied with great pain; and the pain is more agonizing in proportion to the efforts made to overcome the obstruction. When the retention has been of some continuance, the distended bladder can be felt filling the abdomen, and rising as high as the umbilicus. If the retention depends upon an inflammatory affection of the urethra or bladder, it is accompanied with fever from its commencement; but if it arises from paralysis or simple mechanical obstruction, the pulse is at first not affected, but becomes quick in the progress of the disease. As the bladder distends, it inflames and becomes thickened; and unless the patient is relieved either by nature or art, it at length sloughs, when the urine escapes into the abdomen; or before this event takes place the patient dies of abdominal inflammation, or of febrile irritation.

It sometimes happens, when there is no obstruction in the urethra, that after the bladder has become much distended, the sphincter so far yields that the urine passes off in drops from the urethra. The disease looks now like an incontinence of urine, and by an inattentive surgeon the case might be entirely mistaken; but the tumor of the abdomen continues the same, and the urine which escapes by the urethra is only that which has lately passed by the ureters into the bladder.

Retention of urine may always be recognised by the circumscribed elastic tumor of the abdomen, conjoined with the history of the case.

The chief causes of retention of urine are,

1st, Paralysis of the bladder.

2d, Stones in the urethra.

3d, Coagulated blood in the bladder.

4th, Abscesses or tumors in the perinæum.

5th, Inflammation of the urethra and neck of the bladder.

6th, Stricture in the urethra.

7th, Enlargement of the prostate gland.

These are the chief causes of retention in the male; but obstruction to the flow of urine in the female may be produced by Polypus of the uterus, or by tumors in the vagina, by an enlarged ovarium, by retroversion of the uterus, or by pressure from the head of the child during labour. Retention of urine arising from any of the causes which are here enumerated, is capable of being remedied by the catheter; by inducing a state of relaxation by bleeding, the warm bath, and opium; or by puncturing the bladder.

1st, RETENTION FROM PARALYSIS OF THE BLADDER.—This is a frequent cause of retention of urine. It is produced by injuries of the spine, and often occurs in old age, and sometimes in low nervous fevers, and is by no means uncommon after capital operations. The bladder also loses the power of contracting by over-distension. The effect of over-distension producing paralysis is well exemplified in tedious labours, where the head of the child has pressed long on the urethra, and the accoucheur has either been unable or neglected to introduce the catheter. When the child is born, the patient is unable to pass one drop of water, and the abdomen is much distended.

When retention of urine depends upon paralysis of the bladder, it is always remediable by the catheter. As in this case there is no obstruction in the urethra, the instrument can always be introduced, and the urine should be drawn off at regular intervals, three times in the twenty-four hours. The bladder should not be allowed to be much distended, and it is better to introduce the catheter when required, than allow it to remain. The cold bath, the application of blisters to the sacrum, and the internal use of the Tinct. Lyttæ, with the Tinct. Ferri Mur. and other stimulants, will be of use in restoring tone to the bladder in those cases where there is no pressure on the nerves which animate it.

4th, Retention from Abscesses or Tumors in the Perinæum.—Abscesses and tumors situated in the perineum, by pressing on the urethra, sometimes obstruct the flow of urine. In this case the catheter can always be introduced, and we should have recourse to it, till the abscess be opened, or the tumor extirpated. When the obstruction is produced by effusion of blood in the perinæum, in consequence of a kick or a bruise, its absorption will be promoted by the application of cloths dipped in the Aq. ammon. acet. or by that of spirituous embrocations.

5th, Retention from Inflammation of the Urethra and Neck of the Bladder.—The inflammation in gonorrhœa, will frequently, from exposure to cold, violent exercise, hard drinking, and other imprudencies, extend backwards along the urethra to the bladder, causing retention of urine. Unless relief is speedily procured, the inflammatory symptoms increase, the bladder rises above the pubis, and is extremely painful to the touch; the patient becomes hot and restless; the pulse is quick, nausea succeeds, and there soon follows vomiting and delirium. The catheter in this case can always be easily introduced, but before having recourse to it, the patient should be largely blooded, put into the warm bath, have repeated clysters of warm water thrown into the rectum, and then a starch injection with opium, or a large opiate be administered by the mouth. It generally happens that the patient passes the urine while in the bath. If the bath cannot be procured, warm fomentations should be employed; but if neither the bath, the fomentations, nor the other means we have recommended, prove successful, the catheter should not be long of being introduced, and the antiphlogistic remedies should be continued till the inflammatory symptoms abate.

6th, RETENTION FROM STRICTURE IN THE URETHRA.—Stricture in the urethra is the most formidable cause of retention of urine, as, in this case, when the stricture is nearly complete, and more especially when it is of the inflammatory or spasmodic kind, no instrument can be passed into the bladder. When there is great irritation in the urethra, or much febrile action, no attempt should be made to pass either a catheter or bougie; but the patient should be blooded, put into the warm bath, and subjected to the other parts of the treatment we have recommended in inflammation of the urethra. When the smallest catheter or bougie could not be passed, I have frequently, by having recourse to these means, procured a discharge of the urine. It sometimes happens that by forcing a small bougie into the stricture, and allowing it to remain for a few minutes, the patient will be able to pass the water; but should relief not be obtained soon, either the urethra must be opened behind the stricture or the bladder punctured. When the urethra is opened behind the stricture, it is frequently long of healing, and there is danger of extravasation, or of the wound becoming fistulous; but when the bladder is punctured from the rectum, the wound heals immediately, and the operation is attended neither with danger nor pain.

7th, Retention from enlarged Prostate.—Enlargement of the prostate is a frequent cause of retention of urine in the decline of life. The gland has various degrees of enlargement; it is sometimes so much increased in bulk as not only to obstruct the flow of urine, but to compress the rectum, and prevent the free evacuation of the fæces. By the swelling of the lateral lobes, the neck of the bladder is pressed on, the passage distorted, and the flow of urine obstructed; but the chief obstacle arises from the enlargement of the third lobe pressing into the bladder and acting like a valve. This middle lobe, according to the progress of the disease, may vary from the size of a bean to that of a walnut, and I have seen it as large as a middle-sized pear.

In enlargement of the prostate gland, the patient is generally first seized with retention of urine, after drinking or exposure to cold, which produces an inflammatory state of the neck of the bladder; but the catheter can be introduced, and as the inflammation subsides, the obstruction disappears. The gland continues to enlarge, and the same causes in a short time reproduce the obstruction, till at last the slightest irregularity brings on eter is now more difficult gland has attained a certain becomes permanent, and no ed without the catheter. Some under enlargement of the prostate nd are subject only to occasional ob-, which can be remedied by the catheter; for many years previous to their decease, vacuate no water without the use of this in-ment.

In inflammatory states of the gland, the symptoms are the same as in the retention arising from inflammation of the urethra and neck of the bladder, and the patient should be treated in the same manner, by blood-letting, and the warm bath, with large doses of opium. Where there is no inflammatory action it will be necessary only to introduce the catheter and unload the bowels. The catheter can, in general, be introduced. It should be longer and more curved at the point than the one in common use, as the enlargement of the lateral lobes increases the distance from the orifice of the urethra to the cavity of the bladder, while the projection of the middle lobe comes in contact with the point of the instrument, and prevents its entrance. To obviate this difficulty to the introduction, as soon as the catheter has been passed home, its wings should be depressed towards the anus, which raises the extremity of the instrument over the projecting lobe and carries it into the bladder.

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In those cases where the catheter cannot be introduced, it will be necessary to puncture the bladder, but, I may remark, that a chief cause of difficulty in the introduction of this instrument arises from attempting its use in inflammatory and spasmodic stricture, and in inflammatory states of the prostate gland, before having recourse to those means calculated to lessen the inflammation, and induce relaxation. I have known, in such cases, the canal extensively lacerated, and on three different occasions have been forced to puncture the bladder, when it appeared to me that the only obstacle to the introduction of the catheter arose from its entering the false passage produced by previous rude attempts to pass the instrument.

The state of the prostate can always be ascertained by the introduction of the finger into the rectum; and the difficulty of voiding the urine, caused by an indolent enlargement of the gland, will be best treated by the occasional introduction of a large sound or steel bougie, which should be retained as long as the patient can conveniently bear it.

## INTRODUCTION OF THE CATHETER.

The introduction of the catheter is a nice and delicate operation; one which the surgeon is often called upon to perform, and in which, with all his skill, he will sometimes fail; he should practice it frequently on the dead body, in order that he may be able to do it with facility, for it is an operation better learned in this manner, than by any description. There are, however, some obvious rules which should guide the surgeon in the use of the catheter.

Catheters are made of silver, of flexible metal, and of elastic gum. The silver catheter is the one commonly used by the expert surgeon; but if the instrument is to remain in the bladder, one of elastic gum should be preferred, as being productive of less irritation. In many cases the young surgeon will find the flexible metallic catheter a very useful instrument; it possesses such a degree of firmness as permits it to be carried easily along the urethra, and to overcome any slight resistance, while its flexibility enables it to accommodate itself to the natural curve of the canal. This capability of change of form in the instrument is also possessed by the elastic gum catheter. By withdrawing the wire or stilet a little, or by pushing it completely home, the curve of the instrument will be increased or diminished, hence, a surgeon will frequently be able to pass the catheter made of elastic gum when he cannot introduce the silver one. Whichever of the catheters is used, if there is no obstruction in the urethra, one of as large a size as the orifice of the canal will admit should always be chosen in preference to a small one. It will not only be more easily passed in enlarged states of the prostate gland, but by putting the

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the bladder, although it is sometimes arrested by the levator ani or the prostate gland. In this case, by introducing the finger into the rectum, and stretching the membranous part of the urethra, or by lifting up the point of the catheter, it will pass into the bladder.

It is difficult to convey by words the manner of introducing the catheter, and the surgeon may be foiled from a variety of causes, but in the natural state of the parts, the most common cause of obstruction is the triangular ligament through which the beginning of the membranous part of the urethra passes; and the point of the instrument may miss the opening either by depressing the handle too soon, before its point reaches the bulb, or by not depressing it soon enough, till the point has been carried too far on in the direction of the bulb. A little address will in general get over this obstacle, while by employing force, the point of the instrument may be carried through the walls of the urethra, and produce irreparable injury.

## PARACENTESIS VESICÆ.

When the bladder is much distended, when the catheter cannot be introduced, and when the other means which we have recommended fail to evacuate the urine, it will be necessary to puncture the bladder. The surgeon is called upon to perform this operation, generally on account of strictures in the urethra, or enlargement of the prostate gland, as these are the most common obstacles to the introduction of the catheter; but extensive laceration of the urethra may also prevent the introduction of an instrument, and may be another motive for puncturing the bladder. For this last reason, as I formerly observed, I have performed the operation successfully three times.

In the distended state of the bladder there is a considerable portion of it uncovered by the peritoneum, and in any part of this space it may be opened with safety, although it is more accessible at some points than others. The bladder may be punctured from above the pubis, from the rectum, and from the perinæum. Any of these methods is preferable to delay; but to me it does appear that puncture by the rectum possesses advantages over the other two.

## PUNCTURE ABOVE THE PUBIS.

THE operation of puncturing the bladder from above the pubis, is one of the most simple in surgery. The parts, when in their natural position, lie so fairly exposed that any one can perform it whether he understands the anatomy or not; and in proportion as the bladder becomes distended, it carries up the peritoneum and presents a greater surface uncovered by that membrane, so that no immediate danger can occur in the operation. The

the bladder, although it is sometimes arrested the levator ani or the prostate gland. In this c by introducing the finger into the rectum, stretching the membranous part of the ureth by lifting up the point of the catheter, it will into the bladder.

It is difficult to convey by words the manner troducing the catheter, and the surgeon may ed from a variety of causes, but in the natural the parts, the most common cause of obst is the triangular ligament through which the ning of the membranous part of the urethra, and the point of the instrument may m opening either by depressing the handle to before its point reaches the bulb, or by not sing it soon enough, till the point has beer too far on in the direction of the bulb. address will in general get over this obsta by employing force, the point of the in may be carried through the walls of th and produce irreparable injury.

## PARACENTESIS VESICÆ.

When the bladder is much distended catheter cannot be introduced, and whe means which we have recommended cuate the urine, it will be necessary to p bladder. The surgeon is called upo this operation, generally on account [illegible] the urethra, or enlargement of the prostate, as these are the most common obstacles to the introduction of the catheter; but sometimes [illegible] of the urethra may also prevent the [illegible] instrument, and may be [illegible] ing the bladder. [illegible] observed. [illegible] only three times. [illegible] of the bladder [illegible] skin, cellular substance, linea alba, and bladder, may be all perforated at once with the trocar; or the surgeon may make a preliminary incision with a scalpel, but there is no more necessity for this than in the operation for tapping the abdomen, or for hydrocele. In performing this operation, the pubis should be shaved, and the patient placed upon a table or the edge of a bed, with his thighs a little bent towards the abdomen. An assistant, with his expanded hands, should press gently upon the sides of the belly, so as to steady the bladder; and the surgeon, taking a trocar and canula, about four inches in length, and very slightly curved, rests the handle of the instrument in the palm of his hand, and places his fore-finger along the canula. He then enters it slowly and steadily about an inch above the symphysis pubis, so as to pass through the linea alba. The want of resistance, and the escape of a little urine, will show that the instrument is within the bladder, when he should withdraw the trocar, and, at the same time, push the canula farther in. The general directions are to turn the concave side of the instrument towards the pubis, and, in entering, to carry it downwards and backwards; but as there is a danger of the canula slipping out of the bladder as it contracts in the evacuation of the urine, in order to obviate this risk, the concave side of the instrument should be towards the umbilicus, and the trocar entered in a slanting direction obliquely upwards, as if aimed at the top of the sacrum. After the urine has been evacuated, the canula must be fastened by tapes round the patient's body, plugged up with a small spigot of wood or bougie, and allowed to remain for two or three days, till such time as the inflammation has consolidated the wound, when the canula should be withdrawn, having previously passed through it into the bladder an elastic gum catheter. The gum catheter produces less irritation, and removes the danger of a metallic instrument ulcerating the opposite side of the bladder and passing through into the rectum, as happened in the practice of Mr. Sharpe.

The operation which we have now described is the easiest method of puncturing the bladder, but by no means the safest. It is liable to several objections, the chief of which are, the slipping out of the canula as the bladder empties itself, and the consequent escape of the urine into the cellular membrane; the obstruction to its free flow from the oblique position of the wound; and the necessity of retaining an instrument in the bladder till the natural passage is re-established. But where we are prevented puncturing from the rectum, on account of the size of the prostate gland, or other circumstance, this is the operation which the surgeon should have recourse to.

## PUNCTURE FROM THE RECTUM.

The paracentesis of the bladder from the rectum may be performed with ease and safety. The point at which the bladder is to be punctured can be distinctly felt; there is no thickness of parts to perforate, nothing being interposed but the coats of the rectum, with a little cellular membrane; and the opening for the urine is so dependent that I consider it the preferable method of performing the operation. The patient is to be put in the posture for lithotomy, upon a table, or the edge of a bed, and the surgeon places himself on a low seat, while an assistant, with one hand, presses upon the abdomen below the umbilicus, so as to force down and prevent the bladder from receding, and with the other hand holds up the scrotum. The surgeon oils the fore and middle fingers of his left hand, introduces them into the rectum, carrying their points about half an inch beyond the prostate gland, and placing them on the bladder, so that the median line may fall betwixt them. He then takes in his right hand the trocar, having its point retracted within the canula, and carries it along the groove formed by his fingers being in contact. When he has reached its extremity, he gently pushes the trocar from the canula, which he has no sooner accomplished than he depresses the handle of the instrument, and carries its point through the fore part of the rectum into the bladder, upwards and forwards, as if he meant to strike an object half way betwixt the umbilicus and the symphysis of the pubis. The trocar should be more curved and lor [illegible] one which is used in the puncture al [illegible] It should be at least six inches

long, otherwise the canula will not be of a sufficient length within the bladder. As soon as the trocar has been driven home, the fingers are to be removed from the rectum, and, holding the wings of the canula firmly with the fore-finger and thumb of his left hand, the surgeon withdraws the trocar and allows the urine to flow. The canula, secured by means of tapes fastened to a roller passed round the body, is to be retained in its situation for two or three days, when it may be removed with safety; the urine will flow by the rectum, only when the patient makes an effort to expel it, and when the natural passage is restored, the wound will heal with facility.

It has been objected to this operation, that there is a danger of wounding the vesiculæ seminales. These vessels certainly lie in contact at the base of the prostate gland; but as they pass backwards they gradually recede from each other; and if the surgeon keeps in the median line, and punctures from half an inch to an inch beyond the prostate, they are out of all danger, although it appears to me to be of little moment if they were wounded, as the wound would immediately heal and could be followed with no bad consequences. Mr. Colles of Dublin,* conceives that the peritoneum passes so low down betwixt the rectum and bladder, that there is very little space left uncovered betwixt the prostate and the point of reflexion, and that the sur-

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geon cannot therefore so unerringly enter his trocar as to avoid both the vesiculæ seminales and peritoneum. He urges this as an objection to the puncture from the rectum; but it must be recollected that in proportion as the bladder is distended the space uncovered by peritoneum is enlarged, and the vesiculæ seminales are farther separated from each other. To a cautious surgeon there is decidedly room for entering the trocar even when there is little urine in the bladder; but when this viscus is so distended as to call for operation, there cannot be the shadow of danger.

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* Surgical Anatomy, p. 183.

I have now performed the operation many times, and never experienced any difficulty or seen it attended with any danger. The only real objection to puncture by the rectum, is the great size of the prostate gland. When this gland is so large as to preclude the puncture by the rectum, we should perform the operation above the pubis, although I have in two different instances, even when the gland was much enlarged, punctured from the rectum, and, as far as regarded the operation, both the patients recovered; the one was upwards of sixty years of age and lived two years after, and the other was eighty-four years of age; his bladder was punctured six months ago, and he is still alive. In confirmation of the little danger attending this operation, I may remark, that in one patient I punctured the bladder from the rectum three different times; from the two first operations he readily recovered, but his state the third time was such as rendered the case hopeless. The gentleman had strictures in the urethra upwards of twenty years, when the retention of urine became complete. I punctured his bladder on the 26th of December, 1820. In three days the canula was withdrawn from the rectum; and as soon as the urine flowed by the urethra the opening from the intestine healed. He again applied to me on account of retention on the 4th of October, 1822, and I repeated the operation with the same result. I was sent for again on the 3d of September, 1823; two days previous to which, in his efforts to pass the urine, the urethra had given way. The scrotum and penis were now much distended with urine, the parts bordering on gangrene, and he was in a state of insensibility. I again punctured the bladder, made a large incision through the fascia of the perinæum, and free openings into the scrotum and penis, but the patient gradually sunk, and died three days after.

## PUNCTURE FROM THE PERINÆUM.

Puncture of the bladder from the perinæum, although recommended by some surgeons of celebrity, is not the operation most generally practised. The bladder is less accessible from this place than either from the rectum or from above the pubis, and, for other reasons, to be presently stated, it is decidedly the worst method of performing the operation. When had recourse to, the patient must be placed in the posture for lithotomy, and the surgeon on a low seat. An assistant, with one hand holds up the scrotum while he presses with the other on the lower part of the abdomen, so as to force down the bladder, and keep it from receding. An incision is now to be commenced on the left side of the raphe of the perinæum, and carried downwards betwixt the bulb of the urethra and crus penis, to the extent of an inch and a half.—The bulb is to be pushed to the right side by the fore-finger of the operator's left hand; and he should then continue to dissect in the line of incision, till he lays bare the prostate, when he will feel at the bottom of the wound, the distended bladder. He should now take a trocar and canula of the same form and size as recommended for the puncture above the pubis, and by carrying it along the fore-finger of his left hand, which should be inserted into the wound as a guide, pierce the bladder at the basis of the prostate gland on its left side. The trocar is then to be withdrawn, and after the urine is evacuated, the canula must be retained in its place, by means of tapes fastened to a roller passed round the body.

Puncture by the perinæum requires a longer time to perform, is much more painful, and more difficult in the execution, than any of the other methods. In it, besides, there is danger of infiltration of the urine into the cellular substance, and when the prostate gland is much enlarged. it is inadmissible. But if the surgeon will puncture from the perinæum, there is certainly no necessity for preliminary incisions, as he has only to place the fore-finger of his left hand on the left side of the perinæum, betwixt the urethra and the ramus of the ischium, and about an inch and a quarter above the anus, when, if he enters the trocar at this point, and carries it directly in a horizontal line, he will pierce the bladder a little above and beyond the prostate gland. Altogether, this is not an operation I wish to recommend.

Whatever method of paracentesis we adopt, as soon as the bladder has been punctured the irritation abates, the spasm relaxes, and the urine in general soon begins to pass in small quantities by the natural passage. Attempts should now be made to remove the obstruction in the urethra, by means of the caustic, the common, or the metallic bougie, and when this has been effected the puncture in the bladder will immediately heal.

## STONE IN THE BLADDER.

Stone in the bladder is one of the most dreadful diseases with which human nature can be afflicted. There is sometimes considerable difficulty in detecting its existence; and it is often so complicated with other affections of the urinary organs as to render an operation for its removal unavailing, while the operation itself is the most eventful in surgery.

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the bladder, and its point will be apt to start through the membranous part of the urethra, as soon as the internal incisions are begun. It is necessary at the same time, to recollect that the staff should be so held, as neither to hook the pubis, which would endanger the pudic artery in the incisions, nor to press too much down upon the rectum, the effect of which might be to wound the gut. Its proper position is rather nearer the pubis than the rectum, and the instrument should be kept, if possible, in contact with the stone.

Matters being thus arranged, the surgeon, on a low seat, places the forefinger of the left hand on the perinæum, a little to the left side of the raphé, about an inch above the anus, and the thumb about an inch below it, on the rounded part of the hip, so as to mark out the situation and extent of his first incision; and by means of the same finger and thumb pressed a little towards the right side, he stretches the skin. He now takes the knife in his right hand, and commences his incision fully an inch above the anus, close by his finger, a little to the left side of the raphé, and continues it through the integuments in an oblique direction, at equal distances from the tuberosity of the ischium, and the anus, terminating about an inch below the latter, upon the rounded part of the hip, and over the fibres of the glutæus maximus. Recommencing in the upper angle of the wound, and keeping in the line of incision, he passes betwixt the accelerator urinæ and erector penis, pushing the bulb aside with the forefinger

## SYMPTOMS OF STONE IN THE BLADDER.

THE marks which lead us to suspect that there is a stone in the bladder, are as follows: 1st. There is a constant dull and heavy pain in the region of that viscus. 2d, In the evacuation of the urine a sharp pain, accompanied with great heat, stretches along the urethra, and in the emission of the last drops is particularly severe in the point of the glans. This pain is produced by the neck of the bladder coming in contact with the stone, and will be more severe in proportion to its roughness; hence a small stone, if it is rough, will excite more pain than a smooth one, although it is large. The pain in the glans is so distressing, that, with a view to mitigate it, the patient forcibly grasps the point of the penis, and stretches the preputium, and therefore, in boys labouring under stone, we frequently find the foreskin much elongated. 3d, The urine, when flowing in a full stream, often stops suddenly, and cannot be evacuated till the patient changes his posture. 4th, Sometimes the bladder is so irritable, that the urine cannot be retained, but is ejected involuntarily, and not unfrequently, it is discharged in drops with violent straining. This increased irritability, which follows much exercise, is often communicated to the rectum, causing a discharge of the fæces with the urine, and producing tenesmus and prolapsus of the gut, especially in children. The irritability of the bladder is much increased by riding in a carriage, or other rough exercise, and at such times very little urine can be retained. The urine varies much in appearance, sometimes deposites a thick sediment, at other times is quite clear and not unfrequently is tinged with blood, especially after much exercise. 5th, and Lastly, it may be added, that if the disease has been of long continuance, the bladder becomes thickened and contracted, its mucous membrane ulcerates, the patient is exhausted from want of rest, and dies of febrile irritation.

The symptoms now enumerated, do not decidedly mark the existence of stone, as they may also accompany ulceration, tumors, induration, and some other diseased states of the bladder; but as they lead to a suspicion, we have recourse to other means to ascertain if a stone be present. The chief of these is to pass into the bladder a silver catheter, or a solid metallic instrument, which, by coming in contact with the stone, and thereby communicating a peculiar sensation, at once points out to us the nature of the case. This operation is termed sounding.

## ON SOUNDING, AND ON THE MEANS OF ASCERTAINING THE STATE OF THE BLADDER.

When we suspect that a patient has a stone in his bladder, we take a solid steel instrument, of the ligatures by which he is to be secured should be two inches broad and two yards long; they are to be doubled, and a noose put round each wrist; he is then desired to apply the palms of his hands to the outer edges of his feet, grasping the sole with his fingers. By taking several turns with the ligatures, the wrist is secured to the ancle and the hand to the foot. As perfect steadiness is desirable in this operation, the patient should be farther secured by taking a double headed roller, five or six yards long, and about two inches and a half broad; the centre of which is to be placed on the patient's neck, and each end brought down and passed under the thigh from within outwards; when it is to be again carried up to the back of the neck where the ends meet, and where they must be tied together. Having secured the patient in this manner, his breech is now made to project over the edge of the table, while his arms and legs are supported by two assistants, one on each side. The stone being again distinctly felt, the handle of the staff should be turned towards the right groin and slightly depressed towards the abdomen, so as to make the groove present on the left side of the perinæum. The surgeon then commits the staff to his assistant, placed on the right side of the patient, who keeps up the scrotum with his left hand, while with his right he holds and maintains the position of the instrument. Its handle should not be too much depressed towards the abdomen, with the view of making its rounded part protrude in the perinæum, otherwise it will be brought out of

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form of a catheter, and having warmed and oiled it, we pass it into the bladder in the manner recommended for the introduction of the catheter. The catheter itself serves to ascertain the presence of a stone, and by means of it much useful information may be acquired, particularly with regard to the size of the stone, and, what is of as much consequence, the state of the bladder; but as, from its being hollow, it does not convey a very distinct sensation, we have recourse to a solid steel instrument, called a sound. If the stone is large, we shall most commonly strike it immediately on entering the bladder, but should this not be the case, we may succeed by moving the point of the instrument about in various directions, turning it gently upon the axis of its handle, and carrying it towards the fundus of the bladder. Sometimes by carrying the sound perpendicularly upwards and downwards, we shall strike the stone close upon the neck of the bladder, or feel it in the concave part of the instrument. If we should not feel a stone, and the symptoms be still indicative of that disease, the operation of sounding should be repeated next day, or at a longer interval, according to the irritability of the bladder; as it sometimes happens that the different states of contraction of this viscus, or the peculiar position of the stone prevents us from discovering it at one time, while we shall be able to detect it at another.

In enlarged states of the prostate gland the surgeon is frequently unable to discover the stone when it is not very big, from its being situated behind the gland at the neck of the bladder. In this case the sound passes over the stone, and the size of the third lobe of the prostate prevents it from coming in contact with the instrument. To discover it, the position of the patient must be changed, or the fingers introduced into the rectum, and the bladder raised up, when the stone will be forced against the sound and immediately felt. As soon as the sound strikes the stone a peculiar sensation is conveyed to the surgeon's hand, and the stroke can not only be felt but also distinctly heard. From these circumstances, it might be concluded that the surgeon could not possibly be deceived with regard to the existence of a stone in the bladder, but this is far from being the case, as patients have been frequently cut where there was no stone, and I have seen this error occur in the practice of a distinguished lithotomist. A stone sacculated in the urethra, or sabulous concretions in the prostate gland, might lead the surgeon to believe that there was a stone in the bladder; or he might be deceived by its indurated and thickened state, by a tumor in it, and by many other diseases of this viscus; no patient should therefore be cut without other means than the sound being employed to ascertain the existence of stone. It is to be remarked, besides, that the stone may be so small as to pass by the urethra. While the sound is still in the bladder the patient should be brought to the upright posture, and the surgeon should introduce form of a catheter, and having warmed and oiled it, we pass it into the bladder in the manner recommended for the introduction of the catheter. The catheter itself serves to ascertain the presence of a stone, and by means of it much useful information may be acquired, particularly with regard to the size of the stone, and, what is of as much consequence, the state of the bladder; but as, from its being hollow, it does not convey a very distinct sensation, we have recourse to a solid steel instrument, called a sound. If the stone is large, we shall most commonly strike it immediately on entering the bladder, but should this not be the case, we may succeed by moving the point of the instrument about in various directions, turning it gently upon the axis of its handle, and carrying it towards the fundus of the bladder. Sometimes by carrying the sound perpendicularly upwards and downwards, we shall strike the stone close upon the neck of the bladder, or feel it in the concave part of the instrument. If we should not feel a stone, and the symptoms be still indicative of that disease, the operation of sounding should be repeated next day, or at a longer interval, according to the irritability of the bladder; as it sometimes happens that the different states of contraction of this viscus, or the peculiar position of the stone prevents us from discovering it at one time, while we shall be able to detect it at another.

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The operation of lithotomy is always attended with difficulties and danger; and there may occur many states, both local and constitutional, which should prevent a surgeon from operating, but those that I have enumerated are the principal circumstances which either forbid or are unfavourable to operation.

## OPERATION OF LITHOTOMY.

When the surgeon is assured of the existence of a stone, when it has been ascertained that there is no disease in the bladder, and that the constitution is sound; and when the patient is free from acute pain, and does not labour under what has been called a fit of the stone, the operation may be performed. There are various methods of extracting the stone from the bladder, and in each method a multiplicity of instruments has been employed, but the most successful is undoubtedly that which is termed the lateral operation. Hence, notwithstanding its difficulty, it is the one generally preferred; but no surgeon who is not an anatomist, should undertake it. I shall describe this method of performing lithotomy in its most simple form, namely, with the knife and staff.

If the patient is of a plethoric habit, sixteen or twenty ounces of blood should be taken from his arm two days before the operation; the day immediately preceding it the bowels should be emptied by a brisk cathartic; and a few hours before cutting, the rectum should be unloaded by a clyster so as to allow the free introduction of the surgeon's finger, and render the gut less liable to be wounded. The bladder is more easily cut into when distended with urine than when empty, and therefore, to insure a state of distention, the penis should be embraced with a piece of tape three hours, or the bladder may be moderately distended by injecting warm water through a catheter immediately before the operation.

The patient, having had the perinæum shaved, must be laid upon a firm table, about two feet eight inches high, with a blanket under him, and two pillows under his head and shoulders. The surgeon, then, without untying the tape on the penis, introduces into the bladder the staff, warmed and oiled. The staff should be thick, and the groove deep, such as the one recommended by Mr. Charles Bell. A staff of this description keeps the membranous part of the urethra on the stretch, and is more readily cut into, so that the operation is rendered easier and safer. I consider the size of the staff to be of so much importance that, in those cases where the urethra is naturally small, the canal should be dilated by bougies for some days previous to the operation, in order to permit it to receive a large staff. After the staff has been introduced, the patient is to be tied up. Each of the of his left hand. He now completely divides the transversalis muscle passing across the perinæum, and carries his incision into the cellular substance betwixt the anus and the tuberosity of the ischium. During this dissection the surgeon keeps the fore and middle fingers of his left hand within the wound, with his middle finger he presses down the rectum, and with his forefinger turned upwards he guides the point of the knife, until he has laid the urethra bare, by dividing all the cellular substance, with the fibres of the levator ani which cover it. In the upper angle of the wound, under the arch of the pubis, the staff will now be felt through the membranous part of the urethra, as if it were bare, and a little onwards, the prostate gland. The surgeon now directing the point and cutting edge of his knife upwards, makes an incision to the extent of nearly an inch into the groove of the staff, through the membranous part of the urethra, commencing it immediately behind the bulb. The assistant holding the staff, must be careful not to press downwards, as then he would endanger the wounding of the rectum in the subsequent part of the operation. He should take the entire management of the staff throughout, and by so doing the surgeon is enabled to use the forefinger of his left hand, both to protect the rectum, and as a director for his knife, which insures the safety of the operation. While the assistant holds the staff nearly perpendicular, and if possible in contact with the stone, the surgeon turns the back of his knife to the staff, and by the assistance of the forefinger of his left hand, enters its point into the groove through the opening he has already made in the membranous part of the urethra. He slides the knife a little backwards and forwards in the groove, that he may be sure he has fairly entered, then shifts the forefinger, with which he guides the incision, places it obliquely under the knife, and keeps it in that situation to prevent the rectum being wounded. He carries the knife, having its edge obliquely downwards in the direction of the external wound, with a sawing motion, slowly along the groove, till he passes through the prostate, the division of which is denoted by the want of resistance and by the flow of urine. Being now within the bladder, he slowly turns the knife, so as to give it a lateral direction, while at the same time pushing it farther along, he makes with ease and safety, an incision of the form represented in the marginal plate,* and which will be found adequate to the transmission of a large stone. The urine flows out; he slips his finger into the opening, withdraws the knife, and gives it to an assistant, who hands him the forceps, which he passes shut into the bladder, using the fore-finger of his left hand, which is still within the wound, as a conductor. The forceps instantly encounters the staff, which serves to conduct them safely into the bladder, while the finger guides them through the wound.

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* See next page.

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Matters being thus arranged, the surgeon, on a low seat, places the forefinger of the left hand on the perinæum, a little to the left side of the raphé, about an inch above the anus, and the thumb about an inch below it, on the rounded part of the hip, so as to mark out the situation and extent of his first incision; and by means of the same finger and thumb pressed a little towards the right side, he stretches the skin. He now takes the knife in his right hand, and commences his incision fully an inch above the anus, close by his finger, a little to the left side of the raphé, and continues it through the integuments in an oblique direction, at equal distances from the tuberosity of the ischium, and the anus, terminating about an inch below the latter, upon the rounded part of the hip, and over the fibres of the glutæus maximus. Recommencing in the upper angle of the wound, and keeping in the line of incision, he passes betwixt the accelerator urinæ and erector penis, pushing the bulb aside with the forefinger

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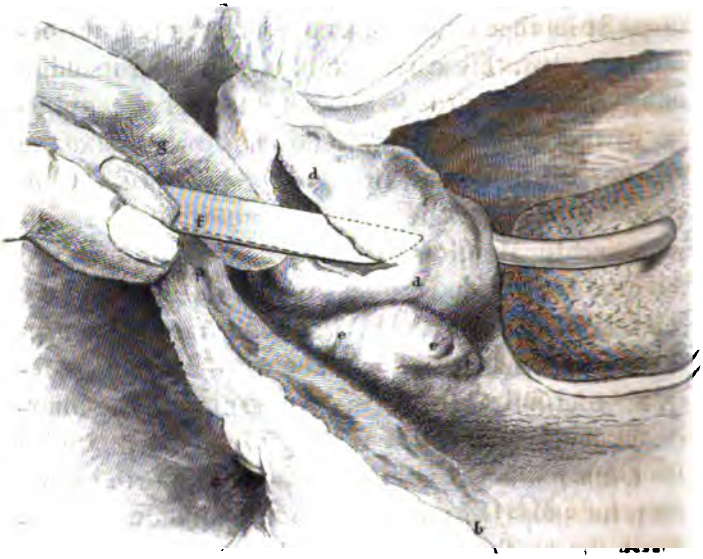
As soon as the forceps are within the bladder the staff is withdrawn; and before he opens their handles, the surgeon, with a view to seize the stone readily, should search for it, and endeavour to strike it. This he will most commonly do by raising the handles of the forceps, and directing their points



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### EXPLANATION OF THE PLATE.

a, b, part of the external incision; c, the anus; d, d, the prostate gland; e, e, the vesiculæ seminales; f, the knife passing through the prostate, and in the act of turning from the oblique to the lateral direction, which gives to the wound a semicircular form; g, the fore-finger of the operator's left hand passed into the wound, placed under the edge of the knife, and pressing down the rectum so as to protect it from being cut.

downwards towards the lower and posterior part of the neck of the bladder. When he has struck the stone, by opening the forceps he will in general catch it; but if not, he fails perhaps from the forceps passing over it. In this case he should withdraw his finger from the wound, insert it into the rectum, and raise the stone up, when he will immediately grasp it; then holding it moderately firm, he proceeds to extract it. He must not pull directly upwards, otherwise he catches on the bones of the pubis, nor directly downwards, otherwise he is apt to injure the rectum. By directing the range of the forceps betwixt the pubis and the tuberosity of the ischium at the same time that he pulls with a moderate degree of strength, he will, in general, easily extract it. If he cannot, the difficulty may arise from the stone being caught in its largest diameter, which will be shown by the great separation of the handles of the forceps. In this case, he must either attempt to change its position with his finger, or let it go and seize it anew. If, however, he finds that the extraction is impeded by the smallness of the wound, he should enlarge it with a probe-pointed bistory guided by the finger. If the bladder should contract upon the stone, no violence should be used in attempting to extract it; but the patient should be put to bed, have a large opiate, and when the relaxation takes place, and suppuration is established, the stone, if not very large, will be found lying in the mouth of the internal wound, and will then be easily extracted.

A chief difficulty which I have observed in the extraction of the stone, arises from the smallness and weakness of the forceps. This instrument should always be big and strong, which gives a much greater command over the stone. The operator should be provided with both curved forceps and straight, as the stone is sometimes placed in a position which the latter cannot reach. On one occasion, at which I assisted, there were two stones; the first was removed very readily, but the second, from the contraction of the bladder, became situated above the pubis, and could not be extracted for want of proper forceps. The patient was put to bed, and the stone, which was afterwards found lying in the mouth of the wound, was easily removed by the finger. In the extraction of the stone, the surgeon will often find the lever, delineated in plate xxi. of great service, and on many occasions even preferable to the forceps.

When the stone is uniformly rough, it is presumed that there is but one present; but the operator should have no reliance upon roughness or smoothness, as marks of there being one stone only or more in the bladder, but proceed to feel with his finger and the forceps, and after having extracted whatever stones are found, if any fragments have been broken off, the bladder must be washed out with tepid water, by means of a syringe or clyster bag and pipe introduced at the wound.

If there is no hæmorrhage, the patient is to be untied, the wound superficially covered, and after being carried to bed, he should be placed on his back, in order that there may be a free exit to the urine.

As the operation of lithotomy may be succeeded by an infiltration of urine into the cellular substance, which occurrence is frequently followed by death, and always by fetid fistulous sores, and a protracted cure, it is advisable in every case to introduce into the bladder through the wound an elastic gum tube, a practice first adopted by Collot, and afterwards recommended by Deschamps. This insures the free discharge of the urine by preventing its escape into the cellular substance, and the tube should be allowed to remain in till the third or fourth day, when the tract of the wound will be so consolidated by the attending inflammation, that it may be then safely withdrawn.

The knife used in the operation of lithotomy, may be a large convex edged scalpel, but the preferable knife is one with a longer blade, and whose cutting edge does not extend its whole length. By the cutting edge being limited, the surgeon is enabled to introduce the forefinger of his left hand with freedom within the wound, to guide the knife, and there is no danger of wounding the pudic artery. A knife similar to that used by Mr. Dubois of Paris, possesses every advantage, and is the one I would recommend. Its blade is four inches in length; but it cuts only within one inch and three quarters of the point; its cutting surface is convex; and the broadest part of the blade which is sharp, is nearly half an inch. The handle is four inches in length, which gives the operator a great command in its use. Plate xxi. contains a correct delineation of this knife. It may be used throughout the operation, or the external incisions may be made with a large convex edged scalpel, and after the groove of the staff has been cut into, the one knife may be exchanged for the other.

## DANGERS RESULTING FROM LITHOTOMY.

Although the operation of lithotomy be simple in itself when conducted upon anatomical principles, yet there is none attended with so many dangers, or in which so many untoward circumstances are apt to present themselves. This peculiarity arises partly from the form of the instruments which are employed, and partly from concomitant circumstances, over which the surgeon has no control.

The dangers which most frequently occur after lithotomy are hæmorrhage, peritoneal inflammation, and infiltration of urine into the cellular substance. When the incisions are made high in the perinæum, the arteria transversalis perinæi is always cut, and for a time discharges blood profusely; but the bleeding in general soon ceases, and in an operation where inflammation is to be dreaded, proves rather beneficial than otherwise. If it should be troublesome, as the vessel is within reach of the needle, it ought to be secured by ligature. The artery of the bulb is also sometimes wounded and gives rise to profuse hæmorrhage; but the bleeding which is most alarming, and which calls for the prompt interposition of the surgeon, is that which arises from a wound of the pudic artery. The pudic artery is most frequently wounded by the gorget. It is sure to be so where this instrument is broad, and when the surgeon in pushing it along, inclines the staff too much to the left side. It has on many occasions been wounded by the bistouré cachée, and also by Blizard's knife, in giving a lateral sweep to the blade when making the incision in the neck of the bladder. The hæmorrhage is always profuse, and as the artery lies deep, it is difficult and in many cases impossible to secure it by ligature. It is wrong therefore to lose time in attempting it. The preferable practice is, for an assistant to press with his finger upon the lower part of the trunk, close upon the inside of the ramus of the ischium, till such time as the surgeon extracts the stone, and when this has been accomplished, to insert into the wound a piece of firm sponge, with a tube passed through its centre. The pressure of the sponge will compress the artery against the bone, and thus stop the flow of blood; and if the tube be carried into the bladder, the urine will easily pass through it. If the sponge be properly applied, it will always effectually suppress any hæmorrhage from this artery.

The second danger which was enumerated as consequent upon lithotomy, is peritoneal inflammation. When the incisions are too small, and repeated rude and ineffectual attempts have been made to extract the stone, the bladder is dragged down, and its peritoneal connections are so much injured, that the operation is often followed by inflammation of the abdominal cavity. The patient complains of pain in the lower part of the belly, particularly acute when pressed on, and accompanied with tension, nausea and vomiting. There is great restlessness, heat of skin, quick and hard pulse, and the alvine evacuations are suppressed. In this case, blood should be immediately abstracted from the arm, and the bleeding repeated till the violence of the pain is subdued; twenty-five or thirty leeches should, at the same time, be applied to the lower part of the belly; glysters of warm water thrown into the rectum, and the patient put into the warm bath; while discharges from the bowels are procured by the Ol. recini, calomel, and other purgatives. After the patient has been freely blooded, blisters to the abdomen are attended with great advantage, and attempts should be made to subdue the vascular action by the exhibition of digitalis. If the surgeon is attentive to the progress of the case, and employs the treatment here recommended in the commencement of the inflammation, it will generally prove successful; but if the disease has made much progress before bleeding is resorted to, or if the patient has endured great violence in the operation, he will hardly recover.

The third, and not the least danger after lithotomy, is the infiltration of the urine into the cellular substance. When the opening into the pelvis is too high, or when the external incision is not carried sufficiently down towards the rounded part of the hip, the urine does not pass freely by the external wound, but insinuates itself into the cellular substance, betwixt the peritoneum and the pubis, or in the neighbourhood of the rectum, producing inflammation and abscess, which frequently prove fatal. This mischance is also apt to occur, from the tumefaction which follows the contusion arising from the difficult extraction of the stone; and, indeed, has often taken place from the swelling and closure of the external wound, although the incisions have been correctly performed and the stone easily extracted. When the surgeon finds, six or eight hours after the operation, that the urine does not flow by the external wound, he should insert his finger and carry it into the bladder, and thus break down any coagulated blood, open up the wound, and give free vent to the urine. As infiltration of the urine into the cellular substance is one of the worst accidents which can follow the operation of lithotomy, every means should be adopted to insure free discharge by the wound. This may be in a great measure effected by placing the patient upon his back instead of his side, and at the same time keeping the thighs apart; by making a free external incision, carrying it down by the side of the rectum to the rounded part of the hip; and by dressing the wound superficially; but more especially by the introduction of an elastic gum tube into the bladder by the external wound. This practice is advisable on every occasion after the lateral operation; it insures the free discharge of the urine, and prevents its escape into the cellular substance.

## EXTRACTION OF SMALL STONES BY THE URETHRA.

In patients labouring under calculous complaints, small stones are frequently discharged by the urethra. They are often of the size of the stones in the fruit of the hawthorn, and, by dilating the passage with bougies, and injecting oil, I have enabled patients to discharge, along with the urine, stones larger than peas. On some occasions, where the stones, although small, have been numerous, they have been productive of so much distress that it has been thought necessary to subject the patient to the operation of lithotomy for their removal. This has arisen partly from the surgeon having no other means of removing them, but chiefly from his not being aware of the size of the stone, while he was certain of its existence by the sound. Although forceps for the removal of stones from the bladder through the urethra, are described and delineated by Sanctorius, two hundred years ago, and since his time by Severinus and others,* yet these instruments do not seem to have ever been applied to practice, at least by the surgeons of this country, till, at the suggestion of Sir A. Cooper, Mr. Weiss, constructed a pair of forceps for removing small stones by the urethra, which, in the hands of Sir Astley himself, and some other surgeons, has proved most successful. In order to enable the surgeon to bring the stones as easily along the urethra as possible, the canal should be dilated by bougies for some days previous to the introduction of this instrument, and in using it the patient should be laid upon his back across a bed, or a couch, with his feet resting on the floor. A catheter is then to be introduced to draw off the urine, and when the bladder is emptied, the urethral forceps are to be introduced and the stone cautiously searched for. When it is caught in the forceps, it should be brought slowly along the urether. If more stones are suspected to be in the bladder, the forceps is again to be introduced, and some of them attempted to be brought away, but the introduction of the instrument should not be too frequently repeated at one time, and great care should be taken in its use, as there is a risk of catching the coats of the bladder, which would be productive of great pain and a discharge of blood. If the use of the forceps has not been followed by much irritation, they may be again introduced at the end of two or three days; but if the bladder is very irritable, and the patient complains of much pain, the irritation must be subdued before the forceps is again used, which may be effected by administering opium by the mouth, or by the opiate glyster, with the warm bath and rest.

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* See Exposé des Divers Procédés employés jusqu'à ce jour pour guerir de la pierre sans avoir recours à l'operation de la taille, par J. Leroy.

### OF BREAKING STONES IN THE BLADDER.

CUTTING for the stone is so eventful an operation, that both patients and surgeons, always eager to avoid it, have long been in search of solvents, or of means for breaking the stone in the bladder, and thus doing away the necessity of performing it. Lithontriptics, or solvents for the stone, can be used in two ways only, namely, either by being taken internally, or injected into the bladder. Whatever is taken by the mouth must pass through the whole range of the circulation, and undergo considerable changes before it reaches the bladder; and if any medicine is possessed of chemical powers sufficiently strong to dissolve the stone when immersed in it, it will also act upon the coats of the bladder. Accordingly, all those medicines which have been taken into the stomach with a view to dissolve the stone, have proved inert, and those which have been injected into the bladder have excited so much pain and irritation that they could not be endured. In the practice of the present day, the destruction of the stone by chemical solvents is never attempted, but it has of late been proposed to break down stones in the bladder by means of a pair of forceps and a circular saw used like a trepan. Two instruments have been invented for this purpose, one by Dr. Civiale of Paris, and another by Mr. Weiss of London. Neither of them has yet been applied to practice on the living body in this country; but the lithontriptor of Dr. Civiale has been used in Paris in three different cases with success; and Messrs. Chaussier and Percy, who were charged by the Royal Academy of Medicine to examine into the operation, have reported favourably on the subject.

Both the instruments act upon the same principle, but, from their size, they can be used only in the adult, and, for the same reason, the urethra requires to be previously dilated by bougies. The lithontriptor of Mr. Weiss will pass along a urethra that will admit the bougie number 17 or 18, and seems calculated to break down a stone which is not of great size. After the stone has been broken down, the bladder requires to be washed out by an injection of warm water.

## CALCULUS IN THE FEMALE.

From the posture in which women evacuate their urine, and from the width, shortness, and capability of distension of the urethra in them, they are enabled to pass sabulous matter, which would form calculous depositions in the male, and hence, stone is a disease which does not occur near so frequently in women as in men. When a woman is afflicted with stone in the bladder, the symptoms are nearly the same as those occurring in the male, but, in her, it is a much more manageable disease, and may be removed either by operation or dilatation.

## LITHOTOMY IN WOMEN.

When the existence of a stone has been ascertained by the sound, and it is resolved to have recourse to cutting instruments, the operation may be performed in the following manner. The patient is to be placed in the same position, and secured in the same manner as the male. An assistant then separates the labia, so as to expose the orifice of the urethra, and the surgeon passes along that canal a straight director into the bladder. Holding the director in his left hand, with its groove inclined obliquely downwards towards the left side, he takes a straight probe-pointed bistory, runs it along the groove, and, in withdrawing the knife, divides the neck of the bladder, and urethra downwards and outwards; thus carrying his incision betwixt the vagina and the ramus ischii. The finger is then to be introduced, and the forceps passed along it into the bladder, with which the stone is to be extracted. Perhaps the operation is fully more simple, by making the incision of the urethra upwards towards the symphysis pubis, as practised by Dubois and Dupuytren. Cutting in this direction may also lessen the risk of incontinence of urine. In performing the operation, Dubois uses a common bistory, and Dupuytren the bistoire cachée.

Lithotomy in women is a very simple operation, and there is no chance of the surgeon missing his aim, but it is generally followed by permanent incontinence of urine. Extraction by dilatation, therefore, seems to be the preferable mode of procedure, unless where the stone is very large.

## EXTRACTION OF THE STONE BY DILATATION.

When a stone is of moderate size in the female, its extraction by the dilatation of the urethra is preferable to the employment of cutting instruments, because any incontinence of urine which may follow is seldom permanent. This mode of delivering the stone in the female, was first practised by Mr. Proby of Dublin, upwards of a hundred and thirty years ago.* He used a metallic dilator, and, by means of it, in a few minutes effected such a dilatation, as enabled him to extract from a girl betwixt eleven and twelve years of age, the largest stone that has yet been recorded as removed in this manner. Douglas afterwards employed sponge tent to dilate the urethra; but the surgeons of the present day generally employ an instrument invented by Weiss, called a dilator. When sponge tent is used, the dilatation is effected in a more gradual manner than when recourse is had to the dilator. The operation, whether by sponge or the dilator, is quite safe, and, if properly managed, is not attended with much pain. When the urethra is sufficiently dilated, the forefinger of the left hand is to be introduced into the bladder, to ascertain the position of the stone, and the forceps is then to be passed, and the stone extracted. By the use of cold bathing, the urethra soon contracts to its former dimensions, and the patient experiences no lasting inconvenience.

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* See Philosophical Transactions for the year 1693.

It is hardly necessary to observe, that the operation for breaking down the stone, when required, must be much more easily effected in the female than in the male.

## SECTION II.

### DISEASES OF THE RECTUM AND ANUS.

The diseases of the rectum and anus, although few in number, are very important. From the delicacy of patients, but still more from the unpardonable carelessness of surgeons, the existence of this class of diseases is often not suspected, and consequently their true nature is misunderstood; and even when the disease is ascertained, it so frequently depends upon constitutional causes, as to be difficult of cure. The most common diseases of the rectum and anus are, stricture of the rectum; imperforated anus; prolapsus ani, and fistula.

## STRICTURE OF THE RECTUM.

Any portion of the alimentary canal may become the seat of stricture, but the disease is most frequently resident in the rectum. In the early stage of stricture of the rectum, the only symptoms which occur are, costiveness, flatulent distension of the bowels, and loss of appetite. The cause from which these arise, is often not suspected, and the disease has frequently made great progress before either the surgeon or the patient is aware of its existence. The first symptom is a difficulty of passing the fæces, which is naturally ascribed to costiveness, as the patient at this time feels no pain. The difficulty gradually increases, the evacuation is in small quantity, lessened in diameter, sometimes flattened or otherwise figured, and, after much straining, is discharged suddenly, as if from a squirt. From the violent and long-continued efforts to empty the rectum, there succeed heat and pain. Upon the introduction of the finger, the coats of the intestine feel thickened, and shortly acquire a cartilaginous hardness; the inner surface of the gut is frequently beset with tubercles, and sometimes there is a hard circular ring. After the costiveness has existed for some time, the stools become loose, there is harassing tenesmus, the belly swells, and the patient is distressed with frequent belchings. From the patient being costive in the commencement of the complaint, and loose after it has lasted for some time, the disease in its early stage is most commonly ascribed to piles, or to a torpid state of the bowels, and in its latter stage, to chronic dysentery, or diarrhœa. Abscesses often form in the neighbourhood of the rectum, which communicate by sinuous openings with the gut. These abscesses either break and discharge externally, or open in the male into the urethra, and in the female into the vagina, or in the latter sometimes burst in the inside of one of the labia. The discharge becomes profuse, the appetite fails, and the patient loses flesh and becomes sallow. After the stricture has been of some continuance, the gut ulcerates, and the fæces become mixed with blood and pus; the heat and pain are extreme; the ulceration assumes the cancerous aspect; the parts adhere, and are massed together, namely, the rectum to the bladder in the male, and in the female to the uterus. There is now great constitutional irritation, with rapid emaciation; and the patient, exhausted with suffering, falls low and expires. It often happens that the patient dies long before the disease arrives at this stage, and apparently from the consequences of obstruction of the bowels. When the obstruction is considerable, the belly swells, the intestines are distended with flatus, a rumbling noise is heard in the bowels, and the patient is occasionally attacked with vomiting. The symptoms now become the same as those accompanying strangulated hernia, and if an irreducible rupture should be present at the same time with a stricture of the rectum, the surgeon is in danger of ascribing the symptoms to strangulation of the gut, instead of to the stricture.*

Stricture of the rectum was considered by the older surgeons an incurable disease, and nothing was attempted by them for its relief but palliatives. It has been imagined to be cancerous, but this appears to be but seldom the case. It is very apt to be mistaken in the female for scirrhosity of the uterus, and in the male for enlargement of the prostate gland. Stricture of the rectum seems to be in general of the same nature with stricture of the urethra, sometimes hard and cartilaginous, at last ulcerating, and, like it, curable by the bougie. Whatever excites inflammation is apt to produce this disease. Thus it may arise from piles or any other irritation, and has followed the extirpation of a hæmorrhoidal excrescence; there is also great reason to believe, from the cases which have occurred, that it is often connected with a venereal taint. From the observations of Desault and some other writers, it appears that women are more subject to this disease than men, and that it attacks them about the meridian of life, or a little after. This remark is consonant with my own experience.

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* See Copland on Stricture of the Rectum, page 70.

I have had a great many patients under my charge, both in the hospital and in private, labouring under stricture of the rectum, and a great proportion of them were females.

Stricture of the rectum most commonly occurs near the termination of the gut, a little within the sphincter, but it may take place in any part of the rectum; sometimes the whole gut is lessened in diameter, and on other occasions, the stricture is situated in the sigmoid flexure of the colon. I have in my possession a preparation, in which, besides a stricture and tubercles in the rectum, with a thickened and hardened state of the coats of that gut, there are throughout the whole course of the colon, contracted and thickened portions; and in which too, although the small intestines were natural, the stomach is girt in the middle as if a piece of thread were tied round it, and its pyloric orifice will barely admit a surgeon's probe to pass. The patient was ill for four years, during the two last of which he suffered great distress.

## TREATMENT OF STRICTURE OF THE RECTUM.

When this disease is detected early, and the stricture is situated in the rectum, more especially if within reach of the finger, it may for the most part be cured by the bougie. When we suspect the presence of the disease, we first introduce our finger into the rectum, to ascertain the situation, extent, and form of the stricture. We then take a rectum bougie of such a size as will just pass through it. After having oiled it, we introduce it, and allow it to remain for ten minutes or a quarter of an hour, more or less, according to the uneasiness which it produces. This practice must be repeated evening and morning, the size of the bougie and the length of time it is to be retained being gradually increased, till the patient is able to wear one of a considerable magnitude for hours without inconvenience. It is also advisable, as in strictures of the urethra, occasionally to introduce the bougie long after the contraction has disappeared, to prevent a recurrence of the disease.

When the bougie is first introduced, it always produces heat, an increased discharge of mucus, and a constant desire to go to stool. This irritability may be allayed by occasionally throwing into the rectum two or three ounces of starch or mucilage, containing eighty or a hundred drops of laudanum; and during the whole progress of the cure, the patient's bowels must be kept open by means of gentle laxatives, such as the infusion of senna, castor oil, or sulphur combined with the supertartrate of potash. It frequently happens that the bougie, when first introduced, causes such excruciating pain that the patient cannot retain it a minute. This is also often the case in stricture of the urethra, where we destroy the irritability by one application of the caustic. I am therefore, of opinion, that where the bougie cannot be retained in the rectum from the same cause, the sensibility of the part should be destroyed by caustic; and when the stricture is situated near the anus, which it often is, the best way to effect this object is to make the patient force down the gut, by straining as if at stool, when we pencil the strictured surface with a strong solution of argentum nitratum, and introduce a piece of lint. After the application of the caustic, the patient will most commonly be able to retain the bougie. The bougies generally employed for the cure of stricture of the rectum, are the common plaster bougie, or those of elastic gum, but a preferable instrument is that made of crystal. From its smoothness it is easily introduced, from its firmness it makes a stronger pressure, and it is applicable to all cases where the contraction is situated in the middle and lower part of the rectum; but when the stricture exists in the upper part of the gut, or in the sigmoid flexure of the colon, the bougie of elastic gum, or that of common plaster, must be used, as their flexibility is better suited for the turn in the gut.

If we are making little progress with the bougie, and the stricture is a mere ring, at the same time that it is situated near the extremity of the gut, it may be divided by the knife, as originally done by Wiseman, and afterwards by Messrs. Copland and Ford. The division of the stricture may be readily effected, by introducing a probe-pointed bistory upon the finger, and cutting posteriorly towards the sacrum; or perhaps it is more advisable to make two or three slight incisions in the strictured ring, after which the cure will be more easily effected by the bougie.

When the disease is connected with syphilis, mercury should be used in combination with the local treatment. Again, when, from the hard and tuberculated state of the gut, attended with burning heat and lancinating pain, there is reason to believe that the disease is cancerous, which is apt to be the case in advanced life, the surgeon, as he can expect no cure, must content himself with palliatives. This treatment consists in the introduction of pieces of lint, covered with an ointment composed of the powder of opium, and the acetate of lead, touching the ulcerated surfaces occasionally with the argentum nitratum, washing the rectum out frequently with tepid water, keeping the bowels as easy as possible by diet and gentle laxatives, and using narcotics when necessary.

## IMPERFORATED ANUS.

Children are occasionally born without any opening for the evacuation of the fæces, but this species of malconformation is very rare. When the circumstance does occur, the defect presents itself under one of three forms. In the first, the rectum is perfect, descending to the extremity of the os coccygis, and the external opening only is covered with a thin membrane. In the second, the anus has its natural appearance, but never having been dilated by the discharge of the fæces, is so small as to admit with difficulty any instrument thicker than a common director. In this case, if forcibly dilated by the little finger, a membrane, and sometimes a firmer substance, can be felt a little within the sphincter, closing up the gut. In the third species of this malformation, there is not only no external opening, but not even the least mark to direct the surgeon to the natural termination of the rectum. In some cases the rectum opens into the vagina or bladder, and sometimes the intestine terminates in a blind sac at the top of the sacrum.

Imperforation of the anus is accompanied with the same symptoms, and is followed by the same consequences as intususceptio, or strangulated hernia. The belly swells, becomes tense, is painful to the touch, and there is frequent vomiting; the child dies, and after death, the intestines are found distended and inflamed.

## TREATMENT OF IMPERFORATED ANUS.

In the first species of imperforated anus, where the termination of the gut is covered only by a thin membrane, the accumulation of the meconium raises it into a distinct tumor, and the fæces can be seen of a dark colour shining through. The mode to be pursued in this case is extremely simple, and is always successful. All that is necessary to be done is to divide the membrane freely by a crucial incision, to wash out the gut with tepid water, and to introduce betwixt the lips of the wound a piece of oiled lint to prevent their re-union, although this is not absolutely necessary, as the natural evacuations keep the opening pervious.

In the second species of this malformation, where the anus is perfect, and where the obstruction is situated within the gut, if there is the smallest opening, it may be dilated by sponge tent, or a bougie; but when this is not the case, the surgeon should introduce his little finger till he arrives at the obstructed point, and by passing a trocar and canula along the finger, and pushing the instrument cautiously upwards, he will often be enabled to carry it through the imperforation. Upon withdrawing the trocar, the fæces will flow through the canula, the bowel must then be washed out with tepid water, and a piece of sponge tent, or oiled lint, introduced to dilate the opening.

In the third species of imperforation, where there is not only no external opening, but no mark of an anus, the case may be considered as hopeless, although the surgeon should no doubt make every effort to form an artificial one. This is to be done by making an incision with a scalpel, at the extremity of the os coccygis, and by carrying it, guided by the finger, upwards into the pelvis, keeping close upon the fore part of the sacrum, which has no curvature in a child. The surgeon must then endeavour to find the termination of the rectum by feeling with his finger for the distended gut. If he feels it, a trocar should be pushed into it. This mode of procedure, however, is extremely precarious, and generally unsuccessful, and very possibly the surgeon may detach the rectum from the sacrum, and getting betwixt it and the bone, open the gut above its termination. In the formation of an artificial anus, the great object of the surgeon should be to pass through the sphincter, for, if he makes an opening above this muscle, the child will be unable to retain the fæces, and pass his life in a very loathsome condition. In those cases where the gut terminates high in the pelvis, there is no sphincter; and although the contents of the bowels may be evacuated, no operation will enable the parts to perform the function of an anus.

In cases where there is no appearance of a natural opening, and where the rectum cannot be found, it has been suggested by Callisen to cut into the colon in the left lumbar region, and thus form a preternatural anus. Littre has also proposed to open the intestinal canal near the groin, and by one or two stitches to retain it in contact with the external wound, till they adhere, by which an artificial anus will be formed. Duret, a naval surgeon at Brest, has put this operation in practice. He made an incision into the sigmoid flexure of the colon, secured the intestine by suture to the external wound, and thus established an artificial opening for the fæces. The child was alive at the time Duret communicated the case, which was two years after the operation. I need hardly remark, with regard to this procedure, that as there is no sphincter to retain the fæces, and that as the intestine is subject to inversion, death at so early an age seems preferable to existence under such deplorable circumstances.

## PROLAPSUS ANI.

Prolapsus Ani is a true inversion of the rectum, and may arise either from irritation or relaxation. The prolapsus, although in general small, is, on some occasions, of considerable magnitude, and always proves a troublesome disease. It occurs more frequently in children than in adults, and in them seldom proceeds from relaxation, but most commonly from irritation. When it arises from the latter, it may often be traced in children to ascarides, and in adults to strong aloetic purges; but costiveness, piles, or any source of irritation, is sufficient to produce it. Although the bowel is in most cases easily reduced, the tendency of the disease to return is so great, that mechanical means have generally been resorted to, in order to support the parts, but a chief part of the cure consists in destroying the irritation.

## TREATMENT OF PROLAPSUS ANI.

THE prolapsed gut should be immediately returned. In children, this is easily effected by taking a piece of thin pasteboard or a common card, and after rolling it up in the form of a cone, and oiling it, its point is to be inserted into the anus, and pushed up, by which it carries the gut along with it. After the bowel is reduced, the surgeon with one hand presses the nates together, while with the other he withdraws the card. In adults, however, it sometimes requires some force to effect the reduction. In this case, we place the patient on his hands and knees, or make him lean forward with his hands supported on a low chair, while he raises his breech by standing on his feet. The surgeon then applies the palm of his left hand, covered with a piece of soft linen, to the lower part of the tumor, and presses it up, while with the fore and middle fingers of his right hand, he pushes the upper part of the gut within the anus. If the intestine has been long down, is much inflamed, and very difficult to reduce, the surgeon must not use force, as he is in danger of materially injuring it. In this case, fomentations of warm water, and warm saturnine solutions should be applied, the intestine remaining unreduced till the inflammation subsides. I have seen the prolapsed rectum, when complicated with hæmorrhoids, so inflamed that it could not be reduced. In one case the prolapsus was as large as the fist, and covered with hæmorrhoidal tumors. It remained down for several days, but when the inflammation subsided, went easily up without any bad consequences.

After the reduction of the bowel, when the disease depends on irritation, and when this arises from ascarides, we attempt the cure by glysters of oil, lime water, &c. When it proceeds from aloetic purges, we employ enemata of starch, or mucilage with laudanum; and when we conjecture that it depends on small ulcerations on the inner surface of the gut, which is sometimes the case in children, we have recourse to injections formed by solutions of alum, or the sulphate of zinc, or decoctions of cinchona, or oak bark.

When the prolapsus proceeds from relaxation, the gut is apt to descend every time the patient goes to stool, but this may be in a great measure prevented by passing the fæces in an upright posture; and if we should find that the sphincter does not retain the bowel in walking, a compress and T bandage must be applied, or the patient must wear a spring bandage with a pad so adapted as to press upon the anus.

When the prolapsus cannot be prevented, it has been recommended to dissect off a portion of the villous coat of the intestine; but although this procedure has on some occasions been attended with success, there is considerable risk of hæmorrhage. Dupuytren has introduced a safer practice; and by this it is said he has cured a number

there is a communication with the gut, as ell as an external opening, the fistula is said to complete. I believe this last to be the most mmon form of the disease. Independently of se three states, the fistula in ano presents a eat variety of appearances. Sometimes the sis runs deep by the side of the rectum, above its mmunication with the gut; sometimes it passes twixt it and the sacrum, so as to encircle the instine; often the gut is extensively separated from e cellular substance; at other times the sinus ns so deep into the pelvis that it cannot be folwed by the knife; and not unfrequently sinuses roceed in various directions into the nates, coverd by hardened and diseased portions of integunents.

Fistula in ano may arise from any of those causes which produce abscess in any other part of the body. The irritation arising from foreign bodies, costiveness and piles, frequently terminates in the formation of matter. Substances swallowed by the mouth sometimes pass along the whole track of the alimentary canal till they arrive at the lower part of the rectum, where they stick in the gut, excite inflammation, and produce abscess. This is often the case with fish bones, pigeon bones, stones of fruit, &c.; but the disease more frequently arises from those causes which impede the circulation in the hæmorrhoidal veins; hence fistula is a common consequence of piles, more especially when they depend upon scirrhosity of the liver. In patients labouring under phthisis, ill-conditioned abscesses frequently form in the neighbourhood of the anus, and degenerate into fistula; the exciting cause here also is obstruction to the abdominal venous circulation. The disease is also often connected with a constitutional cause, as scrophula, syphilis, or intemperance.

Abscesses in the vicinity of the anus are healed with difficulty, because the regenerative process by granulation is perpetually disturbed by the sphincter muscle. Every time the patient goes to stool the action of this muscle tears the granulations, and separates the sides of the abscess. This is a weighty reason for the complete division of the sphincter in the operation for fistula in ano.

## TREATMENT OF FISTULA IN ANO.

WHEN a surgeon is called at the commencement of an abscess in the neighbourhood of the anus, he should, in order to prevent fistula, foment, poultice, and endeavour to bring it early to suppuration; and when matter is once formed, it should be discharged by a large opening. This prevents the abscess attaining a great size, and hinders the matter from insinuating itself deep by the side of the gut. But if sinuses have been formed before the surgeon has been consulted, his first object should be to acquire a correct notion of their course and extent. For this purpose he oils the fore-finger of his left hand, and introduces it into the anus, while he takes the probe in his right, and passing it into the external opening, proceeds to the examination of the sinuses. If the probe passes through till he feels it in the rectum, he at once ascertains that the fistula is complete; if the probe does not pass through, and he traces it running along the side of the rectum, with nothing intervening betwixt it and the finger but the thin walls of the gut, he knows it to be a blind external fistula. In this examination the surgeon should be very minute, as there is often a communication with the gut which escapes observation in consequence of the probe passing beyond it. When there is an opening into the gut, it is, in nine cases out of ten, situated only a little way within the sphincter. The blind internal fistula is with more difficulty detected. Its presence, however, may be ascertained from the pain which the patient feels in voiding the fæces, from the fæces being mixed with pus, particularly when costive, from external hardness in the neighbourhood of the rectum, and from a discharge of matter from the anus when this hardness is pressed on. Sometimes, upon introducing the finger into the rectum, bending a probe, and passing it along the finger, the surgeon will be able to turn it through the opening in the gut into the abscess. Lastly, when fistulæ run into the nates or perinæum, their situation will be pointed out by hardened portions of integument, and the course of the sinuses may be traced by the probe.

In all the varieties of the disease which we have enumerated, it is necessary, in order to effect a cure, to lay open the sinus, and, in the majority of cases, to divide the sphincter. The patient should have a brisk cathartic the day before the operation, and an hour before it a glyster, so as to prevent the early removal of the first dressings by the patient being forced to go to stool. If the sinus is situated on the right side of the anus, the patient should be made to stoop forwards on a bed or a table, raising his nates by standing on his feet; but if the fistula is on the left side, the preferable position is the posture for lithotomy. These positions enable the surgeon to use his right hand in laying open the sinus.

According to the state of the fistula, there is some little variety in the operation. When the fistula is complete, the surgeon should pass the forefinger of his left hand, oiled, into the anus, and taking in his right hand a curved bistory with a probe point, he enters it at the external orifice, and passes it along the track of the sinus till he feels it within the gut. He then brings the point of the knife out at the anus, and thus divides the parts situated betwixt it and the sinus, so as to include the sphincter. It often happens that the sinus runs by the side of the rectum a considerable way above the point of communication with the gut; and it is generally imagined that, in the operation, it is necessary to divide the sinus to its whole extent; but there is reason to believe that justed the instrument, he holds it in his left hand by the handle, and taking a curved sharp-pointed bistory, he passes it along the sinus, and pushes its point through the side of the gut. The point of the knife is received into the hollow of the gorget, so that the opposite side of the intestine is not endangered. The sinus is now to be divided by a sweep of the knife, bringing its point out at the anus, as in the operation for the fistula when it is complete. By placing a bit of wax on the point of the bistory previous to its introduction, the instrument moves more easily along, its sharp point being prevented from catching on the sides of the sinus.

In those cases where the fistula is a blind internal one, we first make it complete by striking a lancet into the external hardness close by the anus, finishing the operation as for complete fistula; and when sinuses run into the nates, they should be laid open and healed, before the chief sinus running along the rectum, is operated on. I may remark, that where sinuses extend into the nates or perinæum, and are attended with callosities, there is no necessity for cutting out the hardened portions. All that is required is to lay the sinus freely open. It frequently happens in fistula, that the external orifice is so small as not to admit the knife with freedom; in such cases the opening may be dilated, the day before the operation, by a piece of sponge tent.

After the fistula has been laid open, the cure much depends on the dressing. The surgeon should immediately introduce dry lint, and next day apply a poultice over it. When the lint loosens and comes out, which generally occurs the second or third day, another bit of lint oiled, or besmeared with simple ointment, should be inserted into the wound, while the poultice is continued. When granulations begin to form, the poultice should be laid aside, and then the best dressing is dry lint gently introduced. If the granulations are languid, action may be excited by dressing with resinous ointment, or the ointment of the red oxide of mercury, and finally the cicatrization will be promoted by touching the sore occasionally with the sulphate of copper, or by applying a bit of lint dipt in a weak solution of that salt.

The surgeon often fails to effect the cure of fistula in ano, by not attending to the state of the constitution. As abscesses in the neighbourhood of the rectum frequently arise from, or are connected with a constitutional cause, such general remedies should be employed as are best suited to the origin of the disease, in conjunction with the local treatment.

In the cure of fistula in ano, the preferable method is undoubtedly by incision; but if the patient be a female, or timid, a cure may be effected in a less alarming manner by a ligature or leaden wire. In this case, a small curved silver canula must be passed through the sinus till it is felt with the point of the finger in the rectum; a leaden wire is then to be introduced through the canula, and its end brought out at the anus. The canula is now to be withdrawn, and a compress of linen or lint placed betwixt the external mouth of the fistula and the anus, over which the ends of the wire are to be twisted. By twisting the wire tighter every day, it cuts itself out, and the wound heals up as this process goes on.

This method of curing fistula in ano, by ligature, was recommended and employed by all the older surgeons, and was a frequent operation till the time of Mr. Pott, who preferred that by incision, which has since been the one in common use. The French surgeons have, of late years, revived the use of the ligature; and Desault, in the second volume of his Chirurgical Journal, gives six cases in which the surgeons of the Hotel Dieu had employed it (a leaden wire) with success; but the ligature is tedious, requiring four or five weeks till it cuts itself out; frequently excites great irritation, and a profuse discharge of matter, by which the patient is much reduced, and in the end is actually more painful than incision.

# CHAPTER XXII.

## DISEASES OF THE MALE ORGANS OF GENERATION.

### GENERAL REMARKS ON THE STRUCTURE OF THE MALE ORGANS OF GENERATION.

There is a curious complication of parts composing the organs of generation in the male; but as my observations are to be confined to the diseases of the penis, scrotum, and testicles, the structure and connections of these parts only will require to be explained.

The penis consists of a variety of structures, but its chief bulk is composed of the copora cavernosa. These are two cylindrical bodies, arising one on each side from the ramus ischii, and terminating in the base of the glans. When their surfaces come in contact they form two grooves, one above and one below. In the upper groove is lodged some of the blood vessels and nerves of the penis, and the lower groove contains the urethra surrounded by its corpus spongiosum. The course and connections of these parts have been already noticed in our observations on the anatomy of the pelvic viscera. The corpora cavernosa are separated from each other by a septum perforated with holes, which allows of so free a communication betwixt the cells of the opposite sides, that when air is blown into one of these cavernous bodies, the other is inflated. On each side of the septum there is an artery which pours out its blood into the cells of the cavernous body on the side to which it belongs, so that there runs through the centre of the penis two arteries, and it is the blood which is thrown out from these vessels into the cells which produces erection. The cavernous structure is surrounded by a tendinous sheath, from the surface of which arise numerous absorbing veins encircling the penis, and forming a trunk in its upper groove, called the dorsal vein.

Under the skin there is a tough ligamentous fascia, which not only surrounds the corpora cavernosa, but the whole penis, binding it firmly in erection. This fascia is a continuation of the suspensory ligament which supports the penis, and which arises about an inch and a half above the pubis. It grows stronger as it descends, and is firmly fixed to the symphysis, where it becomes completely ligamentous; its upper edge is attached to the symphysis, its lower edge to the dorsum penis, and it expands on each side, till it completely envelopes the whole penis from the pubis to the glans.

The skin covers the ligamentous fascia, and is loosely connected with it by cellular substance free of fat. It is prolonged over the glans without being attached to it, and is then folded in, and reflected till it reaches the root of the glans, when it is implanted into the body of the penis. This doubling of the skin forms the prepuce, which covers the glans, and contains betwixt its layers much loose cellular substance. It is this structure which makes the prepuce swell so prodigiously in anasarca.

The arteries which supply the penis are branches of the continued trunk of the internal pudic. They are four in number, two external, and two internal. The two external run in the upper groove, one on each side of the dorsal vein, and the two internal, through the corpora cavernosa, one on each side of the septum, filling their cells with blood in erection.

The scrotum which contains the testicles is divided into two cavities by a septum situated immediately under the raphé. Under the skin is contained a quantity of cellular substance, which, from its reticulated structure, readily distends in anasarca, and in emphysema; and hence, in these diseases, the scrotum becomes enormously enlarged. ,The cellular substance of the scrotum, which is of a fleshy colour, and appears to be of a muscular nature, has received the name of dartos. It contracts the scrotum and supports the testicle. On each side of the septum scroti is situated one of the testicles, and this gland is surrounded by two coats. The first coat, called the tunica albuginea, is in immediate contact with the testicle; closely adheres to it; supports its tubular structure, and is the peritoneal covering which the gland had in common with the viscera when situated in the abdomen. The second coat, named tunica vaginalis, is loose and unconnected. It is formed of that portion of peritoneum which was carried before the testicle in its descent. This gives a loose covering to the testicle and spermatic chord, and, from being a serous membrane, its cavity is not unfrequently the seat of dropsy. The spermatic chord, consisting of the vas deferens, an artery, veins, nerves, and lymphatics, connected by cellular substance, and adhering to the back part of the tunica vaginalis, runs upwards, enters the external abdominal ring, passes along the inguinal canal, and through the internal ring, when the chord separates. The vas deferens then runs down to join the vesiculæ seminales at the back of the neck of the bladder, and the blood-vessels, nerves, and lymphatics, proceed to the loins. The cremaster muscle, arising from the internal oblique, and sometimes also from Poupart's ligament, descends upon the outside of the tunica vaginalis of the spermatic chord, and terminates upon that of the testicle.

## SECTION I.

### DISEASES OF THE PENIS.

The penis is liable to be attacked with the different kinds of inflammation and their consequences. Its most frequent disease is venereal, which we have already treated of in vol. 1st; and its next most common affections are phymosis, paraphymosis, and cancer.

### PHYMOSIS.

When the prepuce cannot be pulled back so as to denude the glans, the affection is termed phymosis. This disease may be either congenital or the effects of inflammation. When it occurs in consequence of inflammation it most commonly depends either on chancre or gonorrhœa. When the phymosis is congenital the affection is most conspicuous in infancy, and in some children it exists to such a degree that the urine does not escape with the same freedom with which it is evacuated from the urethra, but lodges betwixt the glans and the prepuce, frequently depositing small calculous concretions. Phymosis is found to a certain extent in almost all children, and frequently in old men. In the former the affection gradually wears off as the child approaches puberty, which arises partly from the frequent attempts made by boys to denude the glans when they evacuate the urine, and partly from the dilatation produced by the erections which naturally occur at this period of life; but in old age the disease remains permanent, and the tendency to it in many cases is so great, that the foreskin gradually contracts without any apparent cause, till at last no part of the glans can be made to appear. In such cases the urine is often passed with much difficulty.

The most common evils resulting from phymosis are inflammation and excoriation of the glans and prepuce, from the secretion of the sebaceous glands becoming vitiated in consequence of its detention; obstruction to the flow of urine when the opening in the foreskin is smaller than that in the urethra; and pain and laceration in connection. Besides, when sores are situated on the glans or inside of the prepuce, there is difficulty in applying the proper dressings. In cases of excoriation, the opposite surfaces frequently adhere; and when the obstruction to the flow of urine is considerable, the pain is as excruciating as that arising from stricture in the urethra, or stone in the bladder.

## TREATMENT OF PHYMOSIS.

Whether phymosis be congenital or produced by disease, it can only be effectually cured by an operation; in some cases it may no doubt be removed by dilatation, but as this method is always tedious and uncertain, it is preferable to have recourse to a surgical operation, which consists in either cutting off a portion of the contracted foreskin or slitting it up. The former of these is termed circumcision, and the latter is the common operation for phymosis. They may be performed to obviate any of the evils which we have enumerated as arising from phymosis; but no operation should be had recourse to while the prepuce is inflamed. There is no necessity for circumcision, or for the division of the foreskin, in order to enable the surgeon to dress venereal sores. Chancres can always be kept clean, and proper remedies be applied, by means of injecting fluids with a syringe, or by inserting a probe armed with a bit of lint. When there is much inflammation, saturnine and opiate fomentations, with injections, are the proper remedies, and not incision. If incision is practised in such cases, the operation will be followed by a profuse and troublesome hæmorrhage, difficult to manage, and the inflammation will be increased, and the parts be in danger of falling into gangrene. An operation is, properly, adapted for congenital phymosis, or for those cases where the prepuce remains contracted after the inflammation is abated.

When the prepuce is much elongated, circumcision should be preferred, as leaving the parts less deformed than when the foreskin is slit up. The operation is simple in itself and speedily performed. An assistant grasps and supports the penis, while the surgeon lays hold of as much of the foreskin with a pair of lip forceps as is judged proper to be removed. He then, with a straight bistory, at one stroke cuts off the portion held by the forceps, carrying his knife close to their blades, which serve as a guide for his incision. If any vessel bleeds profusely, it must be secured by a ligature, and the edges of the two layers of the foreskin should be kept in contact by means of a few points of the interrupted suture, formed by a common sewing needle and thread, or by a small surgical needle.

The common operation for the relief of phymosis by longitudinal incision, may be performed either with a sharp-pointed bistory, or with what is termed the phymosis knife, which is a combination of the bistory with a director, or a bistoire cachée, and the prepuce may be cut either at the sides or in the middle; but if cut in the middle, the bleeding will be more profuse, from larger branches of the veins being divided. When the surgeon uses a straight sharp-pointed bistory, it will be necessary to put a bit of wax upon its point, then, taking hold of the prepuce, and stretching it with the thumb and fore-finger of his left hand, he introduces the flat side of the knife betwixt the foreskin and glans, carrying it as far back as he can; then turning the edge of the knife upwards, he pushes its point through the skin, and, by bringing it towards him, the prepuce will be divided as the instrument is withdrawn. When the proper phymosis knife is used, it must be introduced in its concealed state, in the same manner as we have now recommended; and by depressing its handle with the thumb, the point of the knife will be elevated and forced through the skin. The surgeon must continue to press upon the handle while he draws the instrument towards him, by which the division of the prepuce will be effected. A chief point in performing this operation is the complete stretching of the prepuce before the knife is pushed through, otherwise the two layers, of which it consists, will be unequally cut. If not thus stretched, the outer lamina will be divided its whole length, while the under one is only partially so. This arises from the inner membrane being more retracted than the outer. In nine times out of ten that I have seen the operation performed, this unequal division of the two laminæ has happened. If, notwithstanding the precaution recommended, the inner layer be not divided to the same extent as the skin, its division should afterwards be effected with fine scissars. It may be necessary to observe, that when the prepuce is cut in congenital phymosis, the upper lamina of the skin will in general separate and retract from the lower. To obviate this, they should be kept in contact till they inflame and adhere, which may be done by a few stitches of the interrupted suture passed near their cut edges. After the operation, a little lint is to be applied to the bleeding surface, and the penis put into a bag, open at the end, so as to permit the urine to escape.*

## PARAPHYMOSIS.

When the prepuce has been forced back behind the glans, and cannot again be brought forward, the affection is termed paraphymosis. This complaint frequently occurs in boys who have a trick of pulling back the foreskin; but in them the inflammation is in general very inconsiderable, and there is, consequently, seldom any danger of gangrene from the stricture. The disease is of a much more serious complexion in the adult, as when the foreskin has been for some time back there follows an effusion of serum betwixt its layers; the skin behind this inflames and ulcerates; and if the inflammation be violent, which is generally the case, there is great danger of its ending in mortification of the glans.

## TREATMENT OF PARAPHYMOSIS.

If the surgeon has been called to the patient early after the occurrence of the paraphymosis, he will almost always succeed in the reduction by immersing the penis for a short time in cold water, compressing the glans, and forcing the blood out of it with his thumbs, while, with his fingers, he pulls forward the prepuce. If this practice should not succeed, recourse must be had to other means. In children, the prepuce will be found swelled and œdematous; but, in general, there will be little inflammation or swelling in the glans. In such cases, all that will be necessary is to puncture the foreskin fifteen or twenty times with the point of a lancet, and immerse it in warm water to encourage the bleeding; after which, cold saturnine poultices should be kept constantly applied. By these means the swelling will be so much reduced, in the course of two or three days, that the skin may be easily brought forward. A more decided practice is required in the adult. This consists in inserting a hernia director under the foreskin, and carrying its point beyond the corona glandis, when the surgeon, with a small scalpel, should divide the stricture by cutting down into the groove of the director. After the operation the prepuce, from being inflamed, cannot in general be brought over the glans; but when the inflammation subsides, it comes forward of its own accord.

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* In the operation for phymosis, Cloquet has lately recommended to divide the prepuce at the lower part, and parallel with the frenum, instead of at the upper, which, he says, is not attended with any subsequent deformity. I not long ago performed it in this manner. The wound healed readily, and the deformity was certainly much less than when the prepuce is cut in the usual way.

## CANCER OF THE PENIS.

THE penis is subject to cancer, particularly in the decline of life. Like cancer of the lip, it generally begins by the appearance of a small wart on the glans or prepuce, which sometimes remains stationary for many years, till, upon being irritated, it becomes painful, grows rapidly, at last ulcerates, and discharges a fetid sanies. The sore is of a dark copper-colour, and irregular on its surface, with hard unequal edges. The adjacent parts are also hard and of a purple colour; sometimes the whole sore consists of warty or cauliflower-like excrescences; there is always a burning heat; and it frequently happens that fistulous openings are formed in the urethra through which the urine is discharged. When the disease has existed for any length of time, the lymphatic glands in the groin swell and become painful.

Venereal warts are apt to be mistaken for Cancerous excrescences, but as the error would lead to a severe practice for the cure of a comparatively trifling disease, the surgeon should have distincly impressed on his mind the discriminating marks of the two affections. The venereal wart has a slender base, is loose and movable, is in general devoid of pain, and the neighbouring parts are free from disease; whereas cancerous excrescences have a broad base, are firmly rooted, seem to spring from the centre of the part to which they are attached, are accompanied by burning or lancinating pain, and the adjacent parts are in general hard and discoloured.*

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* For a detailed account of cancer, see vol. 1st, p. 235.

## AMPUTATION OF THE PENIS.

The penis may require to be amputated on account of carcinomatous affections. In performing the operation, Mr. Benjamin Bell, and the generality of English surgeons, direct to draw the skin back before the first incision is made, or at least, before the corpora cavernosa be cut through, but this direction is evidently improper, for, so soon as the penis is divided, it shrinks into the perinæum, by which the skin projects and hangs loose, and having no secreting glands to defend it from the acrimony of the urine, it inflames and becomes excoriated. The skin should therefore be drawn forwards instead of back. Le Dran is the first writer who gives directions for the amputation of the penis; he desires the skin to be drawn forwards, as the corpora cavernosa shrinking leave a superabundance of skin; and his method of operating is that which has been practised by the French surgeons.

In this operation, the patient should be seated on a high chair, and, to prevent the retraction of the penis when cut through, an assistant should firmly grasp it close by the symphysis pubis. The surgeon then with his left hand, laying hold of the penis, drawing it towards him, and putting the skin completely on the stretch, takes a bistory in his right hand, and divides it with one stroke of the knife, taking care to cut upon a sound part, so that all the disease may be effectually removed. The bleeding arteries are now to be secured by the tenaculum and ligature. Their number will be in proportion to the size of the parts, and state of the disease; but our anatomical knowledge teaches us that they are in general four, the two dorsal arteries, and the two which run in the corpora cavernosa close by the septum. The surgeon should be particularly careful to secure every vessel which is distinctly seen throwing out its blood, as patients have died of hemorrhage after amputation of the penis; and if there should be much bleeding from the cells of the corpora cavernosa, a gum catheter must be introduced into the bladder, or a silver canula passed into the urethra, and a fine linen bandage rolled firmly round the penis. Indeed, whether there be hemorrhage or not, the introduction of a large gum catheter will always be found useful, as it not only keeps the orifice of the urethra from contracting, but at the same time carries the urine free of the wound, and prevents its discomposing the dressings. In dressing the wound, the skin should be brought together at the upper part, so as to cover the spongy bodies, and retained by black court plaster. The whole is then to be covered with lint and bandaged up.

When it is necessary to amputate the penis close by the symphysis, in order to prevent the retraction of the corpora cavernosa, and enable the surgeon to secure the vessels, the operation must be more slowly performed, and the parts not be divided at once. The first incision should pass through the skin into the upper part of the corpora cavernosa, but no farther than merely to divide the dorsal arteries and expose the ligamentous sheath and upper part of the septum. Through the cut sheath, and at some little distance from its edge, a small tape or thick ligature should now be passed, by means of a surgical needle, and after being knotted and committed to the charge of an assistant, the surgeon may with safety complete his incision, by carrying his knife through the remaining part of the body of the penis. By means of the tape, all retraction will be effectually prevented, and the surgeon will be enabled to draw out the corpora cavernosa, and tie the arteries. The tape should be allowed to remain for two or three days for fear of accidents. In this manner, Langenbeck effectually and successfuly removed the penis close by the symphysis pubis.

## SECTION II.

### DISEASES OF THE SCROTUM AND TESTICLE.

In consequence of blows and other external injuries, blood is frequently effused into the tunica vaginalis, or into the cellular substance of the scrotum. This effusion seldom requires an operation for its removal, being in general easily discussed by spirituous and stimulant embrocations. The disease of this part therefore, that demands our chief attention, is hydrocele, as being of very frequent occurrence.

The testicle itself is very liable to disease. From its extreme delicacy of structure it is easily hurt, and soon inflames. Its diseases bear a great similarity to those of the female breast; some are of a benign, and some of a malignant nature; and the latter soon affect the general health. The chief affections to which the testicle is subject, are scrophulous enlargement, sarcocele or fleshy enlargement, benign fungus, scirrhus, cancer, and fungus hematodes.

## HYDROCELE.

Hydrocele is a collection of a serous fluid within the tunica vaginalis testis. The true nature of this disease was unknown to the ancients. The older surgeons imagined that the fluid was not formed in the cavity in which it was contained, but that in every case it descended from the abdomen. Even so late writers as Le Dran and Garengeot, had such incorrect notions of this complaint, that they believed it to be formed by a sac of water which had adhered to the testicle. Sharp and Monro Primus, were the first writers who seem to have known the true seat of hydrocele; but our knowledge of it is now so perfect, that there is no disease with the pathology or cure of which we are better acquainted.

The surface from which the fluid in hydrocele is effused, is a serous membrane; and writers have ascribed the disease to increased secretion, or diminished absorption. It generally occurs without any obvious cause, although on some occasions it can be traced to a blow succeeded by inflammation, When this is the case, the effusion in general does not take place during the inflammatory action, but after it has ceased. Hydrocele most commonly occurs only on one side, but sometimes is present in both divisions of the scrotum at the same time. It takes place at all periods of life, but prevails more frequently in warm climates. The fluid is always transparent, of a straw-colour, and, like the serum of the blood, coagulates by heat and acids, except when the testicle is diseased, and it is then commonly turbid. Hydrocele in general proceeds by imperceptible steps, but sometimes is suddenly formed. One patient who applied to me with a hydrocele, in the account he gave, stated that the disease appeared in the course of a single night; I drew off about six or seven ounces of fluid of a straw-colour, and injected the cavity of the tunica vaginalis with success. When a hydrocele is once formed, it sometimes increases rapidly in size, and sometimes slowly. In some patients it becomes of such a size in a few months, as to require operation, in others it takes years to attain the same bulk, but it possesses one peculiarity, namely, that in proportion as the exhalent surface increases by the distension of the tunica vaginalis, the swelling advances with augmented rapidity. Hence a hydrocele that has existed for a year, will grow in the next six weeks as much as it did in all the preceding twelve months put together.

Hydrocele is apt to be confounded with several other diseases, more especially with hernia, sarcocele, and fungus hematodes. The characteristic marks, therefore, which distinguish it, should be carefully attended to. In hydrocele the tumor is in general of a pyriform shape, having the larger end downwards; but on some occasions it is oblong, and appears girded in the middle as if embraced by a ligature. The swelling always commences at the bottom, and proceeds gradually upwards. It can be handled or pressed on without pain, and there is no affection of the general health. It never can be pushed up into the belly; if the patient be laid upon his back, and the contents of the tumor be directed towards the groin, the termination of the tumor will be perceived, as the swelling does not enter the ring. The testicle is most commonly situated at the back part, below the middle of the tumor, and can generally therefore, though not always, be felt. The abdominal ring is always free; and sometimes fluctuation can be distinctly perceived by laying the fingers on one part of the tumor, while pressure is made on another. There is also sometimes transparency upon presenting a candle, or upon exposing it to the rays of the sun. The transparency of the tumor at once declares the nature of the disease; but this is not a constant symptom. If the hydrocele has not attained its full size, the transparency will not be perceived, unless we grasp the tumor firmly in one hand, and, while we present the candle with the other, press its contents forwards to its anterior surface. In this examination, the patient generally complains of pain from the pressure on the testicle. On the other hand, if the disease has been of long standing, the tunica vaginalis, by distention and inflammation, acquires so much thickness that it cannot be seen through. Heister says, that in one case he found the tunica vaginalis half an inch thick; and both Mr. J. Bell and Sir A. Cooper have seen it ossified. Transparency, therefore, is not always present in hydrocele.

Hydrocele may be distinguished from hernia both by its history and by other circumstances. In hernia the swelling commences at the top, and proceeds downwards; it generally appears suddenly, and follows some violent exertion. There is an impulse given to the tumor on coughing. If not strangulated, or adhering, it can be returned into the abdomen, and sometimes it disappears spontaneously upon the patient lying down on his back. If the hernia is strangulated, there will be nausea, vomiting, general uneasiness, and complete constipation, with pain on pressure, both in the tumor and in the abdomen.

Sarcocele will not be mistaken for hydrocele, if the surgeon is the least attentive in his examination. The diseased state of the testicle is preceded by inflammation and long-continued pain, and there is hardness and irregularity of surface. The tumor wants the smooth and rounded form of hydrocele, feels much heavier, and the veins of the scrotum are varicose. Sometimes, indeed, there is such an accumulation of fluid within the tunica vaginalis, that the bulk, hardness, and irregular form of the testicle, cannot be felt except at the back part; but still the tumor is heavier, there is pain, and an affection of the general health, whereas, in hydrocele there is neither pain nor constitutional derangement.

Fungus hematodes of the testicle is apt to be mistaken for hydrocele; and, on some occasions, has been punctured by the trocar with a view to inject. Although fungus hematodes has the same elastic feel as hydrocele, it may be distinguished by being heavier for its bulk, by the spermatic chord being felt free, and by an enlarged state of the subcutaneous veins. In the discrimination of disease, much depends upon the history of the case; and, I may remark, that hydrocele will be recognised, not so much by its elasticity, fluctuation, and transparency, as by its progress.

I have now described the most common form under which hydrocele appears; but it is necessary to observe, that there are many varieties in this disease. It is frequently complicated with hernia.

Sometimes the hernia is in a distinct sac, exterior to the tunica vaginalis, in which case it does not descend so far down as the bottom of the scrotum. At other times both diseases are congenital; the hernia is then lodged within the tunica vaginalis, and the water of the hydrocele can be returned into the abdomen, as there is a free communication betwixt these cavities, which also sometimes exists when there is no protruding bowel.

I have stated that the testicle is generally situated at the back part, below the middle of the swelling; but on some rare occasions, the gland will be found adhering to the tunica vaginalis on its fore part, and the water is then collected at the sides and bottom. It is proper to keep in view the possibility of such an occurrence, as, on one occasion, I saw the surgeon push his trocar into the body of the testicle instead of entering the sac, and he was obliged to pass the instrument a second time before the water flowed.

## TREATMENT OF HYDROCELE.

In the adult we always have recourse to an operation for the cure of hydrocele; but in childhood the disease may be cured by keeping constantly applied to the scrotum, cloths wet with the Aq. Ammon. Acet. or with a solution of the muriate of ammonia of such a strength as to inflame the skin. I have seen this practice successful, when immediately had recourse to, even in the adult, in cases where the disease had returned after injection.

There are two methods practised for the cure of hydrocele. The one is called the palliative, and the other the radical cure. The palliative method consists in merely evacuating the water by a lancet or a trocar, in order to remove the uneasiness, or other bad consequences produced by the distension. The operation is free of pain, and void of danger; and on some occasions we practise it, although in general we at once attempt the radical cure, which consists in not only evacuating the fluid, but in exciting such a degree of inflammation in the testicle and tunica vaginalis as either to obliterate the cavity, or to change the nature of the secreting surface. It is generally imagined that after injection the cavity is obliterated by the adhesion of the opposite surfaces. This is, no doubt, sometimes the case; as is proved both by feeling the parts, and also by dissection; but it is equally certain that the disease may be cured without adhesion taking place, otherwise the hydrocele could not return months or years after a cure had been effected; and on examination after death, on some occasions, the opposite surfaces were found not to be adhering.

After the water has been evacuated, whatever excites inflammation will cure the hydrocele: thus it has happened, that in consequence of a patient walking several miles after the water has been simply evacuated by puncturing with a trocar, so much inflammation has been excited as to cure the disease. The sole intention, therefore, in the operation for hydrocele is to excite inflammation, with a view to make the opposite surfaces adhere; to fill up the cavity by granulation; or, to change the nature of the secreting surface. Six different operations have been practised to accomplish this one purpose, namely, 1st, Excision or the removal of the sac. 2d, The opening of the tunica vaginalis by caustic. 3d, The introduction of a tent into the cavity. 4th, The passing of a seton through the sac. 5th, Opening the sac by incision. And, 6th, The injection of a stimulating fluid after the evacuation of the water. All of these methods have succeeded in effecting a cure; but the first four have been found to produce so tedious and painful an inflammation, in some cases terminating in death, that they are altogether abandoned, and the only methods now practised are, Incision and Injection.

Incision.—The cure by incision is more certain than that by injection, but is liable to many of the inconveniences and dangers attending those methods which are now abandoned. It is, therefore, not generally practised, but when had recourse to, may be done in the following manner:—The patient is to be laid on his back on a table or a couch, the surgeon then grasps the tumor with his left hand, and taking a scalpel or bistoury in his right, makes an incision through the integuments on the anterior surface, from the upper to the lower part of the scrotum, which immediately retracts, and exposes the tunica vaginalis or sac. An opening is then to be made into the upper part of the sac, either with a lancet or with the point of the knife, sufficient to admit the finger, into which it is to be inserted as a director, and the knife being carried downwards, the vaginal coat is thus laid open through its whole extent. The forefinger of the left hand, while it serves as a director for the knife, at the same time keeps back the testicle. A piece of lint well oiled is now to be inserted betwixt the lips of the wound, but not stuffed in so as to excite great irritation. A compress is afterwards to be applied, and a T bandage. The compress and bandage should be removed on the third day; and, in order to promote suppuration, a warm emollient poultice must be applied. After suppuration has been established, no other dressing is required than a bit of oiled lint, which is to be renewed from day to day till the cure is completed.

The cure by incision is both tedious and painful, and the operation on some occasions is followed by high symptomatic fever, and, as we have already remarked, other alarming symptoms. It is now, therefore, seldom practised, the preference being given to injection.

INJECTION.—The cure of hydrocele by injection was practised in France upwards of 150 years ago. The injection used was a weak solution of the muriate of mercury in lime water. Monro, an army surgeon, and after him, Mr. Sharp, injected spirits of wine. These stimulating fluids, although they often effected a cure, on many occasions produced such high and dangerous inflammation, that the practice by injection was condemned by Douglas, Le Dran, and other celebrated surgeons. Port wine pure, or diluted with water, was afterwards used with success in France. It was adopted in this country by Sir James Earle, and first recommended by him. This method of cure has now become general. The instruments required are a trocar and canula, which should be of a rounded form, and nearly two inches in length, and a common bladder, which is preferable either to a syringe or an elastic gum bottle, as it is not so apt to inject air; to the bladder should be attached a brass tube with a stop cock, accurately fitted to the canula. The injection generally used consists of port wine and water, but I have long been in the habit of using either pure wine or cold water; and I find that they are equally successful. I have sometimes succeeded with cold water when I had failed with wine, and on other occasions have effected a cure with wine when I had failed with cold water.

In performing the operation, the patient should be placed in a chair; and the surgeon seating himself before him, grasps the tumor in his left hand so as to distend it and make its fore part protrude. He now enters the trocar at the lower and anterior part, pushing it forwards and directing its point upwards. By carrying the trocar in this direction, he avoids wounding the testicle, which would be endangered if the instrument was passed in a horizontal line. The trocar should now be withdrawn; and as soon as this is done, the surgeon should push the canula into the tunica vaginalis as far as it will go, which will prevent its slipping out, and remove the danger of throwing the injection into the cellular substance. As soon as the water has been evacuated, the tube attached to the bladder is to be introduced into the canula, when the surgeon proceeds to inject slowly, by compressing the sides of the bladder, till he has distended the sac to nearly its original size. Whenever the cold fluid comes in contact with the testicle, the patient generally experiences an unpleasant sensation, which has sometimes produced fainting. The length of time the injection is allowed to remain must, in a great measure, depend upon the feelings of the patient. If he complains of acute pain in the testicle, stretching along the chord, uneasiness in the loins, faintness or sickness at stomach, after being retained for two or three minutes, the injected fluid must be evacuated; but if he feels no pain, it should be retained for five, eight, or ten minutes. After the injection is returned the canula is to be withdrawn, and a piece of adhesive or black court plaster applied to the wound. A compress is then to be laid on the scrotum, and the whole supported by means of a T bandage, and the patient put to bed. If the operation is to succeed, there takes place, on the second or third day, a redness and swelling of the scrotum. The tumefaction is sometimes hard and in other cases soft, from which it would appear that the cure may be effected in one of two ways. When the swelling feels hard, it consists entirely of an enlargement of the testicle very painful to the touch; but when soft, there is evidently an effused fluid, which looks like a return of the disease, but which, in a few days, is absorbed. The inflammation and swelling generally continue till the sixth or eighth day, when they gradually subside; but in some instances I have known the inflammatory action so great as to terminate in suppuration, and even in sloughing of the scrotum. If the inflammation threatens to be too great, the surgeon must have recourse to warm fomentations, saturnine solutions, and purgatives, confining the patient to a horizontal posture: if, on the contrary, it is trifling, he should be allowed to sit up, and even to walk through the room, in order to excite the necessary action.

The treatment of hydrocele by injection is both simple and easily performed, productive of little pain, and, in the majority of cases, successful. In hydrocele, the testicle is often enlarged; but this is no objection to the operation. The surgeon may inject with safety, although the testicle be of considerable magnitude, if there be no pain, hardness, nor irregularity on its surface; but if these symptoms be present, the fluid should be merely evacuated, which may be done from time to time; and no injection should be used, as there is danger of inflaming and thus exciting an active disease in the testicle.

The point of chief importance to be attended to in the operation by injection, is to ascertain that the canula is within the tunica vaginalis before the surgeon proceeds to inject, otherwise the fluid, passing into the cellular substance, is apt, not only to excite such an inflammation as will terminate in gangrene, but to be accompanied with so much constitutional irritation as may involve the life of the patient. I have, on several occasions, seen this accident occur through the inattention of the surgeon; and, in one case, the patient died from the latter cause.

## SCROFULOUS ENLARGEMENT OF THE TESTICLE.

The testicle is often attacked with scrofula; and, like the same disease in the female breast, is not unfrequently confounded with cancer, although the characterizing symptoms are very distinctly marked. The gland becomes enlarged, but feels soft and pulpy, hangs lower than usual, and is in general void of pain. The spermatic chord is not affected; but the disease is confined solely to the epididymis and body of the testicle. This enlargement occurs in scrofulous habits; and is generally accompanied with other glandular affections, is frequent in children, and peculiar to early life. The testicle often suppurates, discharges for a length of time a serum mixed with curdled flakes, and heals like other scrofulous abscesses, with the skin puckered and drawn in. Sometimes the gland suppurates at several points; and, when the ulcerations heal, its structure is so changed that the function is entirely destroyed. I have known this loss of function from scrofulous suppuration occur in both testicles, and prove a cause of impotency.

## TREATMENT OF SCROFULOUS ENLARGEMENT OF THE TESTICLE.

The local treatment of scrofula of the testicle should be conducted in the same manner as is recommended for that of the female breast; and the constitutional treatment will be found detailed in the first section of specific inflammation, Vol. I.

## SARCOCELE OR FLESHY ENLARGEMENT OF THE TESTICLE.

The testicle, from unknown causes, frequently becomes hard, enlarged, and of a fleshy consistence. It feels very firm and hangs heavy; but is free from pain, except what is produced by its weight. The disease is entirely confined to the testicle, and there is no affection of the chord. The tumor is at first smooth on its surface; but in the progress of the disease small irregularities take place which are soft to the feel, and are found to contain a bloody sanies. The testicle at last ulcerates, or seems to burst from distension, then shoots out a fungus which discharges a bloody serum, and ruins the health.

This fleshy enlargement of the testicle may be mistaken for fluid within the tunica vaginalis, and, indeed, there is frequently so much fluid contained within this coat, that the enlarged testicle cannot be felt. The disease is at first taken for a common hydrocele, but as soon as the fluid is evacuated, the testicle is found to be so completely diseased as to require extirpation. This complication of fluid with enlarged testicle, constitutes the disease termed hydro-sarcocele.

There seems to be no limits to the growth of sarcocele; sometimes the tumor attains the size of the fist; more commonly acquires a much larger bulk; and I have seen it bigger than the head of an adult.

As from several cases related by the late Mr. Ramsden, it appears that there is a species of sarcocele without inflammation or pain, referable to irritation within the urethra, and depending upon a contraction or stricture, it is advisable to introduce a bougie into the urethra, to ascertain if there be a stricture or other cause of irritation within that canal. The fourth and fifth cases in Mr. Ramsden's book are instances of this kind.

## TREATMENT OF SARCOCELE.

The testicle is an organ of great importance in the animal economy, and many of its diseases not only destroy its structure and function, but in process of time affect the health. This is the case with sarcocele, and, from its tendency to increase in size, it requires to be extirpated, except in those cases in which the disease depends upon stricture in the urethra, and which are curable by the bougie.

## BENIGN FUNGUS OF THE TESTICLE.

In consequence of gonorrhœa, a blow, exposure to cold, or from some less obvious cause, the testicle often inflames and swells, and the swelling is attended with hardness and pain stretching along the chord. The inflammation proceeds rapidly to suppuration, and as soon as the skin ulcerates, there springs forth a firm red excrescence which possesses little sensibility. This fungus is not loose and moveable, but is firmly attached to the body of the testicle, and feels as if it sprung from its centre and formed a part of the gland. When the abscess bursts, and the fungus appears, the pain considerably diminishes.

From the thickening of the integuments, the hardness of the testicle, and the appearance of the fungus, one unacquainted with the disease would be led to imagine that the testicle was cancerous; but as soon as the fungus is destroyed, the ulceration heals, and the cicatrix formed is puckered and drawn in like the scar of a scrofulous sore.

## TREATMENT OF BENIGN FUNGUS OF THE TESTICLE.

Benign fungus of the testicle, although formidable in appearance, is easily cured. It may be removed either by the knife, or by ligature, and destroyed by the actual or potential cauteries. The ligature is painful and tedious in its operation, and should never be employed where the knife can be used with safety; and when caustics are sufficiently powerful to destroy fungi, we never have recourse to the actual cautery, as it is both painful and alarming. In the cure of benign fungus, we may therefore employ either the knife or caustics. When the fungus is large, the best practice is to remove it by the knife, applying to the cut surface a bit of dry lint; but when it is small, it may be touched daily with the argentum nitratum, or its surface may be washed with a hair pencil, dipt in a strong solution of that salt, or of the muriate of mercury, taking care to remove the eschar before each application of the caustic, and after it has been applied, to dress with dry lint. After the fungus has been removed or destroyed, the sore will heal with little trouble.

## SCIRRHUS OF THE TESTICLE.

Scirrhus is one of the legitimate terminations of inflammation in glandular structure, and scirrhus of the testicle frequently follows hernia humoralis. But in this case it is not so apt to end in cancer, which is more likely to follow where the scirrhus, without any apparent inflammation, commences either in the testicle or epididymis.

After inflammation of the testicle, the gland often continues enlarged, becomes hard, unequal, or irregular on its surface, with increased weight; but still it is free of pain although its function is lost. There is a slight uneasiness in the loins from its weight, and there is no change of colour in the skin. This state of the gland is called scirrhus, and generally begins small like a pea, but gradually increases in size. Mr. Ramsden says, that to these symptoms there are superadded derangement of the system and shooting pain, by which it appears that he, like many other practitioners, confounds scirrhus with occult cancer. In scirrhus there is neither pain nor derangement of the system, though the function of the gland is lost, because its structure is destroyed; whereas in occult cancer there is lancinating pain, which is more acute on handling the testicle, or on the changes of weather. Cancer in a gland is always preceded by scirrhus; and the sole difference betwixt the two diseases is, that in scirrhus, there is only enlargement, stony hardness, knotty and irregular surface, with destruction of structure and function, but no pain; whereas in occult cancer, there are all these symptoms, with pain superadded.

## TREATMENT OF SCIRRHUS OF THE TESTICLE.

SCIRRHOSITY of the testicle seldom affects the general health, and as long as the part remains free from pain, the disease does not call for operation. It is only when the testicle has become painful that it requires to be extirpated. In the state of scirrhus, the testicle should be supported by a suspensory bandage, attention should be paid to the state of the patient's bowels, and to the regular performance of the other functions, while every thing which tends to excite vascular action should be carefully avoided.

## CANCER OF THE TESTICLE.

WHEN a scirrhous testicle becomes painful upon handling or after exercise, it has just begun to assume the cancerous action, which gradually increases till the health of the patient becomes involved. The pain is at first trifling, like that from the pricking of needles, occasionally darts through the tumor, but soon begins to increase in frequency and violence, stretching along the chord to the loins, when the testicle becomes larger, harder, and more knotty, or irregular on its surface. After the testicle has been for some time affected, the disease extends to the chord, the spermatic veins become varicose, the arteries are enlarged, and the cellular substance and spermatic sheath condensed and thickened. A quantity of ichorous fluid is now effused into different parts of the substance of the tumor. An effusion, it was remarked, frequently takes place in sarcocele, but there is this difference betwixt the two cases, that in sarcocele the effused fluid is confined to the cavity of the tunica vaginalis, whereas in cancer, the fluid, which is either pus or sanies, is contained within the substance of the gland or under the tunica albuginea. The cancerous action still going on, and the disease extending, the tunica vaginalis begins to adhere to the testicle, and the scrotum firmly to the tunica vaginalis. The skin becomes of a livid or dark red colour, the superficial veins are varicose from the compression of those within the tumor, and the patient cannot move, nor the tumor be touched without the most excruciating pain. It at last ulcerates, and discharges a thin ichorous bloody matter; the ulceration extends, accompanied by a burning heat; the edges of the sore are hard, retorted, and painful to the touch; and the ulcer shoots out irregular fungi. The spermatic chord is now much inflamed, thickened, and enlarged, and the lymphatic glands in the groin, within the pelvis, and in the mesentery, are completely diseased, from the inflammation extending along the lymphatics, or from the absorption of the cancerous virus. The general health is ruined long before this destructive process is accomplished; for early in the disease, or shortly after the cancerous action is established, the patient begins to complain of loss of appetite, attended by affections of the stomach and bowels; the countenance becomes sallow, the body is emaciated, and the strength sinks. As the disease advances, the sallowness of the countenance and the emaciation become more apparent; the patient complains of violent pains in the back and belly; the liver and other glandular viscera of the abdomen become quite diseased; his strength sinks rapidly, and he dies in great torture.

In cancer, the body of the testicle is generally first affected, and then the epididymis and chord are drawn into disease; this, however, is not always the case, for it sometimes begins in the epididymis, but never in the chord, at least as far as I have observed.

## TREATMENT OF CANCER OF THE TESTICLE.

The only cure for cancer of the testicle is extirpation; and the earlier the operation is performed the greater the chance of success.

## FUNGUS HEMATODES OF THE TESTICLE.

Fungus hematodes, or medullary sarcoma, is the last disease of the testicle which we enumerated. The structure is as completely changed in this affection as in scirrhus, but instead of the testicle becoming hard, and acquiring an irregularity of surface, it is smooth, soft, and pulpy. Fungus hematodes, like cancer, generally begins in the body of the testicle, although sometimes in the epididymis. It increases by slow degrees, and is at first like a scrofulous testicle, not attended with much pain. The testicle at first swells, is smooth and uniform on its surface, and has a soft and elastic feel. The swelling, however, is not long confined to the body of the testicle, but soon extends to the epididymis, forming a tumor of an oval shape, soft, springy or elastic, with an obscure sense of a deep-seated fluctuation. The patient complains more of uneasiness in the loins, owing to the weight of the tumor, than of pain in the affected part. The spermatic chord becomes at last enlarged, but instead of being hard or painful to the touch, it remains soft, and has a full and elastic feel.

After the tumor has acquired a large size, and the disease made a certain progress, the veins of the scrotum become varicose; from the compression of the internal veins, the lymphatic glands in the groin swell as well as those within the pelvis in the course of the chord; and sometimes these glands are so knotted and massed together as to form a tumor within the abdomen, equal, if not exceeding in size the enlarged testicle. Fungus hematodes, like cancer, soon involves all the neighbouring parts; the patient becomes exhausted with fever and suffering, falls low and expires. For further remarks on fungus hematodes, see chapter on specific inflammation, volume first.

## TREATMENT OF FUNGUS HEMATODES OF THE TESTICLE.

In fungus hematodes of the testicle, the only cure is extirpation; but unless early performed, before the system becomes affected, the operation is never successful. The disease appears by no means alarming at first, hence the glands within the body are generally affected before extirpation is thought of; and this is the cause of the operation failing to effect a cure.

## EXTIRPATION OF THE TESTICLE.

SARCOCELE, cancer, and fungus hematodes, are the chief diseases of the testicle for which we perform the operation of castration. These diseases originate in the substance of the gland, and although local at first, soon affect the general health. Cancer and fungus hematodes more especially require to be early removed; and, indeed, the operation is more successful in proportion to the shortness of time the disease has existed. When the chord is enlarged up to the abdominal ring, hard, unequal, and painful to the touch, attended with lancinating pains stretching to the loins, no operation should be attempted. While we pronounce this interdiction, we may at the same time observe, that the enlargement and varicose state of the spermatic chord is in itself no objection to the operation. It is only when the chord is enlarged and at the same time hard, knotty, and painful to the touch, or diseased within the abdomen, that we must not extirpate; and if we are cautious not to attempt an operation in these circumstances, much more careful should we be not to operate in the advanced stage of the disease, when the system has become affected. Thus, as we do not remove the mamma when the liver or lungs are diseased, we ought not to extirpate the testicle when the mesenteric glands, liver, or any of the abdominal viscera are affected, or in those who are universally dropsical, or much exhausted by febrile irritation, because there is not only no chance of the operation being successful, but it always hastens the death of the patient. The operation is also unfavourable in old age, and in drunkards.

When the testicle is to be extirpated, the patient may be seated in an arm chair, but it is preferable to lay him on his back on a table, with his legs hanging over its edge. The surgeon then grasps the tumor in his left hand, and with the scalpel in his right begins his incision a little above the ring, carrying it down to the bottom of the scrotum. When the integuments are sound, we make only one longitudinal incision, dissect out the testicle, and leave the whole skin; but when they are diseased, or when they adhere firmly to the testicle, as soon as our longitudinal incision reaches the top of the tumor we depart from the straight line, and make two incisions, each of a semicircular form, so as to include the diseased or adhering integuments, which are to be dissected out with the tumor. As soon as the external incision is accomplished, the surgeon should proceed to expose the chord a little below the abdominal ring, and to separate it from the surrounding cellular substance. At this part of the operation, it is generally directed that the surgeon should, by means of a curved or aneurismal needle, pass a large ligature round the chord, to prevent it when cut, from suddenly retracting within the ring; but there is no necessity for this ligature, and its use may be followed by bad consequences. If the assistant raises up and supports the testicle with one hand, while he grasps the chord betwixt the forefinger and thumb of his other hand, it may be divided without fear of retraction. If the ligature is had recourse to, and pulled with any degree of violence, there is not only excessive pain, but the chord will be materially injured above the point where it is divided, and will then inflame and swell. However, it must be remembered that the lifting up of the testicle and the grasping of the chord betwixt the forefinger and thumb are important directions; and that, by not attending to them, the chord, when cut, has, from the action of the cremaster muscle, retracted within the ring, and patients have died of hemorrhage. While the assistant supports the testicle, and grasps the chord betwixt his finger and thumb, the surgeon slips the forefinger of his left hand under it, and then slowly divides it upon his finger, securing by ligature the spermatic artery and the artery of the vas deferens, as they are divided, and before the chord is quite cut through.

After the chord has been divided, and its arteries secured, the surgeon lays hold of that portion of it connected with the testicle, and pulling it towards him, separates with the scalpel the testicle from the scrotum. Any of the arteries of the scrotum which bleed, are to be taken up by the tenaculum, and secured.

As soon as the arteries have been secured, and the coagulated blood washed away, the lips of the wound are to be brought together and retained by two or three stitches of the interrupted suture with strips of adhesive or black court plaster, and the whole is to be supported by compresses of lint, and the T bandage.

# CHAPTER XXIII.

## DISEASES OF THE FEMALE ORGANS OF GENERATION.

### GENERAL REMARKS ON THE STRUCTURE OF THE FEMALE ORGANS OF GENERATION.

THE organs of generation in the female have been divided into the external and the internal. They are very simple in their anatomy; but in compliance with the plan which I have adopted, I shall offer a few remarks on their structure and relative connections, preparatory to treating of their diseases. The external organs consist of the labia majora, the clitoris, the labia minora or nymphæ, the hymen in the virgin, and the carunculæ myrtiformes in the female who has had intercourse with man; but we may also enumerate the urethra and the perinæum, as being sometimes the subject of accident or operation.

The labia majora are of various sizes, depending much upon the fatness of the female. They are composed of loose cellular substance covered by the skin; and their inner surface is a mucous membrane, beset with sebaceous glands, and possessing great sensibility. Like the female breast, one of the labia is sometimes larger than the other.

The clitoris is situated immediately within the junction of the labia majora at the upper part; it consists of two corpora cavernosa arising from the ramus ischii, and a glans, is similar to the penis, and is, like it, subject to erection. The clitoris is generally about a fourth of an inch in length when erected; sometimes it is shorter, and in a case of malformation I have seen it three inches long. The glans, which is extremely sensible, is covered by a preputium, which is continued downwards within the labia majora to form the nymphæ.

The nymphæ are of a spongy and vascular structure, and possess great sensibility. They generally terminate about half-way down the labia majora, but, in some cases, are continued down to the point where the labia join at the commencement of the perinæum. The chief use of the nymphæ seems to be, to allow of a more free distension of the external parts during labour; like the other parts which we have already described, they vary much in size, particularly at different periods of life. In children they commonly protrude beyond the external lips, in the adult they are hid by them, and, in one case which fell under my observation, they were entirely a-wanting.

The hymen is a membrane of a semilunar shape, with an opening at its upper part to permit of the discharge of the menses. It is situated a little within the entrance of the vagina, and is ruptured in those who have had intercourse with the male. Sometimes this membrane is so strong as to prevent the due consummation of marriage; and, in other cases, it has had no opening in it, in consequence of which the menses have been retained so as to distend the uterus, producing distressing symptoms, and giving rise to the suspicion of pregnancy.

The carunculæ myrtiformes are small fleshy excrescences, surrounding the orifice of the vagina in women who have had commerce with men, and are just the remains of the ruptured hymen.

Upon separating the labia, the meatus urinarius, and the entrance of the vagina, come into view. The meatus urinarius or orifice of the urethra in the virgin, is situated a little below the clitoris, in the female who has had intercourse with man, close upon the entrance of the vagina, and in the woman who has borne many children, within the entrance of that passage. The urethra is about two inches in length, wider than in the male, and is capable of great dilatation. It runs on to the bladder in a straight direction, or at least is very slightly curved; its upper part lies under the arch of the pubis, and its lower surface is in contact with the vagina.

The perinæum varies in length; in the virgin it is generally an inch and half or more, in married women shorter, and in those who have borne many children it is almost obliterated.

The internal organs of generation in the female are the vagina and uterus, with its ovaria and fallopian tubes.

The vagina is of a curved form, longer behind than before; its upper surface is in contact with the urethra and neck of the bladder, and its lower one with the rectum. Its upper and posterior surface is covered by the peritoneum. This passage possesses little sensibility, is of a conical form, becoming gradually wider as it approaches the uterus; and although its sides lie in contact, and the uterus can be felt about three inches from its orifice, this tube is capable of great dilatation and elongation. The inner surface of the vagina is full of rugæ, which are particularly well marked in the virgin, less perceptible in the married woman, and nearly obliterated in her who has had many children. There is always present a copious secretion, arising from a number of lacunæ situated in its lining membrane.

The uterus is situated betwixt the bladder and the rectum; its cervix or neck is, as it were, suspended in the vagina, and can be more distinctly felt at the upper and back part of that passage than at its upper and fore part. The uterus is about three inches in length, two in breadth at the fundus, and one at the neck; but it differs much in size according to the states both of virginity and of child-bearing women. Its cavity is of a triangular form, and lined with a very vascular membrane, from which the menstrual blood is secreted. The uterus is supplied with four arteries of considerable size, which inosculate freely with each other, the uterine hypogastric coming from the internal iliac and entering at the upper part of the cervix, and the spermatic arteries arising from the aorta a little below the emulgents, and sometimes from the emulgents themselves, and passing into the uterus near its fundus. Notwithstanding the dilatation of the uterus during pregnancy, the arteries continue of the same size as in the unimpregnated state, but the veins are dilated to two or three times their original dimensions.

The fallopian tubes arise from the upper corner of the uterus; run across the pelvis about three inches, and terminate by an opening in the middle of the fimbriæ. This canal is very small towards the uterus, only admitting a hog's bristle, but gradually enlarging as it approaches the fimbriæ. The use of the fallopian tubes is to convey the ovum from the ovarium to the uterus.

The peritoneum is reflected from the forepart of the rectum so as to cover the back part of the neck, the body, and fundus of the uterus, it then descends on the forepart of this viscus, from which it is reflected upon the bladder. The uterus is, therefore, completely covered by the peritoneum; and this membrane passing off laterally, forms the broad ligaments. The fallopian tubes and ovaria are included in a duplicature of the peritoneum.

The round ligaments go off from the uterus a little below the fallopian tubes, they are about the size of a goose quill, and run down to pass through the ring of the external oblique muscle, when they are inserted into the cellular substance at the top of the thigh. The pain in the groin which women complain of during pregnancy, arises from the stretching of these ligaments, in consequence of the expansion of the womb.

The ovaria are two oval bodies, of the size and shape of olives, contained in the duplicature of the peritoneum, and situated about two inches from the uterus, behind, and a little below the fallopian tubes. They perform the same office in the female that the testicle does in the male.

## SECTION I.

### DISEASES AND ACCIDENTS OF THE EXTERNAL PARTS.

INDEPENDENTLY of inflammation and its consequences, to which the external parts of generation in the female are particularly subject, there are several diseases which call for the assistance of the surgeon, such as morbid enlargement of the parts, tumors and malformation; but before proceeding to offer any remarks on the nature of these maladies, I shall say a few words on the introduction of the catheter.

## INTRODUCTION OF THE CATHETER.

The introduction of the catheter in the female is extremely easy to one acquainted with the anatomy of the parts, and, for obvious reasons, the operation should always be done without exposure. The patient should be placed on her back, with her thighs separated, and her legs pulled up, resting on the soles of her feet. The surgeon then takes the catheter in his right hand, and laying the forefinger of his left upon the pubis, he carries it down betwixt the labia till he touches the clitoris, when, by moving his finger a little downwards under this point, he will feel the papilla surrounding the urethra. He should now turn the forepart of his finger upwards, and passing the catheter along it, the instrument will readily enter the passage. If there is no mechanical obstruction, by carrying the catheter horizontally forwards, it will pass into the bladder, but should there be any difficulty, arising from the pressure of the head of the child, or from a tumor in the vagina, the wings of the instrument must be depressed and its point carried forwards closely under the arch of the pubis.

## ADHESION OF THE LABIA.

The labia frequently adhere in children, and sometimes in the adult from excoriation ; and this is particularly the case in warm climates. In children the adhesion is often so complete as to resemble a malformation of the parts, only a small opening being left for the passage of the urine. When the opening is so small as not to permit the urine to escape so quickly as it is expelled from the bladder, the pain is as excruciating as that arising from stricture or stone.

In infancy, the surgeon will frequently be enabled to separate the adhering labia by laying the child on its back and forcibly pressing them asunder by his thumbs. If he should not be able to effect their separation in this manner, he may, with the greatest safety, employ the knife. While an assistant attempts to separate the parts, the surgeon should carry the edge of a small scalpel lightly along the seam or raphé pointing out the line of adhesion, when they will readily separate. After the separation has been effected, reunion must be prevented by the insertion of a bit of lint, wet with a solution of alum, the acetite of lead, or any other astringent.

The labia are frequently the seat of tumors, or excrescences; and whether they are benign or malignant, they should always be dissected out, but if malignant, and the glands of the groin are affected, no operation will cure the disease. In the removal of those tumors or excrescences which have a narrow base, the ligature might be used, but the knife is always preferable, as being more expeditious, and, on the whole, attended with less pain.

## ENLARGEMENT OF THE CLITORIS.

The clitoris is frequently enlarged, but very seldom so much so as to become the object of surgery. It is said to have grown to such a size in some cases as even to equal the penis; hence females with this enlargement have been ignorantly styled hermaphrodites. The clitoris may become scirrhous, or it may be affected with cancer; when this is the case it should be removed by the knife, or when the part becomes so large as to be inconvenient, or to excite uneasiness, this practice may be adopted. The surgeon must expect the operation to be followed by a considerable hemorrhage from the corpora cavernosa, and should be particularly careful to secure the bleeding vessels. On the 13th of September, 1813, I removed the clitoris from a woman, twenty-seven years of age. Its glans was about the size of a hen's egg, but of a more rounded form. The tumor had been growing for twelve months, and had rapidly increased for the last three months. It was firm and fleshy, but free of pain, and was troublesome chiefly from its weight; however, for the fortnight before its removal, she complained much of a gnawing pain in her left groin, and top of the left thigh, which was so distressing during the night that she said she hardly knew in what posture to lay her thigh, so as to procure ease. There were no enlarged glands in either groin; I separated the tumor from the top of the nymphæ, and the operation was quickly performed, as the body of the clitoris was not enlarged, but, upon being cut through, the corpora cavernosa immediately shrunk, and she lost ten or twelve ounces of blood before the vessels could be secured. She was well in three weeks.

## ENLARGEMENT OF THE NYMPHÆ.

The nymphæ are sometimes so much enlarged as to impede the natural functions. When they become so large as to protrude beyond the labia, they in general lose their sensibility, and their mucous surface becomes dry, and acquires the appearance of the skin; but on other occasions they inflame and swell. When attacked with inflammation, saturnine solutions and fomentations should be employed, but when callous, they may be removed either by the ligature or the knife. If the knife is employed, profuse hemorrhage may be expected, as the nymphæ are very vascular, and particularly so when in a diseased state. The bleeding vessels should, therefore, be carefully secured, and the hemorrhage from the smaller vessels checked by cloths dipt in cold water, or by styptics and pressure.

Warts are often situated upon the nymphæ, or on the inside of the labia, but most commonly in the cleft betwixt them; they are generally venereal, but I have seen them from the size of a bean to that of a walnut, and in very great numbers, where no such cause could be assigned. It is common to apply to warts calomel, sabine powder, red precipitate, and other escharotics, but this practice should be avoided as much as possible in the female, as from the natural contact of the parts, and their secretion, it is always productive of great excoriation and inflammation. The best practice is to apply a small ligature to the base of every such excrescence, and after it has fallen off, to touch its root with argentum nitratum, or with the sulphate of copper. If the ligatures produce much inflammation, it should be moderated by washing the parts frequently with a saturnine solution, or by employing warm anodyne fomentations.

## IMPERFORATION OF THE VAGINA.

It sometimes happens that the vagina is shut up by the hymen being imperforated; and when this is the case, the malconformation is apt to pass unnoticed till the age of puberty. The menses do not then flow, although the female be labouring under all the symptoms of menstruation. The secretion takes place, but cannot be evacuated; the vagina and uterus become distended to a great degree; the patient is afflicted with sickness, headach, and pains in the loins, and in the bottom of the abdomen; the uterus contracts as in labour, and this state of excitement continues for several days at a time. At length, from the distension of the uterus, a tumor appears above the pubis, which is apt to lead to the impression that the female is with child. If the surgeon attempts to introduce his finger into the vagina, he will feel a tense membrane obstructing its introduction; and, upon exposure, he will perceive the dark-coloured blood shining through, although this is not always the case, as the membrane is sometimes very thick and of a ligamentous nature. When the imperforated hymen is thin, fluctuation will be felt by employing alternate pressure with one hand laid upon the tumor above the pubis, and placing the fore-finger of the other upon the hymen; but if this membrane is thick and fleshy, no fluctuation will be perceived.

There are many cases on record of imperforated vagina, where a cure was effected by the free division of the hymen. Dr. Denman relates the case of a young woman, twenty-two years of age, who had many uterine complaints, and in whom the abdomen was so large that she was suspected to be pregnant. She had never menstruated. When she was examined, the circumscribed tumor of the uterus reached as high as the umbilicus, and the external parts were stretched by a round soft tumor at the entrance of the vagina, presenting the same appearance as when the head of a child is passing through them. There was no opening into the vagina. The hymen, which was thick and fleshy, was divided by an incision, and there were evacuated about four pounds of blood, of the colour and consistence of tar, and without putridity, when the swelling of the abdomen immediately subsided, and every distressing symptom was removed.

The operation for imperforated vagina is performed by making a crucial incision in the hymen with a scalpel, and preventing its reunion by the insertion of a piece of sponge tent. The hymen is sometimes of so thick and tough a texture that it cannot be ruptured by the embraces of the male; in this case there is a small opening for the discharge of the menses. If the obstruction should prevent the due consummation of marriage, the opening may be enlarged by making several stellated incisions in its edges.

## LACERATION OF THE PERINÆUM.

The perinæum is lacerated only during labour. In brutes the accident never happens, and in the human female it occurs but seldom. The perinæum is most commonly lacerated from before backwards, but sometimes it is torn close by the anus, and the child passes through the opening. Laceration of the perinæum is more apt to occur in first labours; in females advanced in life, where the parts are rigid and the labour rapid; in premature labours; in a wide pelvis, when the pains are very strong, and where the head descends suddenly before the external parts have had time to dilate; in face presentations; and in using the forceps. When this accident does take place, it is sometimes followed by violent inflammation, attended with suppression of urine; the patient is unable to sit or walk, and the urine coming in contact with the lacerated parts causes great pain.

When laceration of the perinæum occurs, there is reason to believe that it is to be imputed more frequently to the imprudence and hurry of the medical attendant, or to the voluntary exertions of the woman, than to the structure of the parts. In a case which occurred to Dr. Denman, he was sensible of the laceration taking place close by the anus before the expulsion of the child, which he guided through the natural passage, supplying the want of the perinæum by the palm of his hand. The Doctor remarks, that "in this patient the external parts were extremely rigid and contracted; and as I applied myself with great assiduity to preserve them, I imputed the accident to this circumstance rather than to the necessity of the case. The patient did not make any unusual complaint immediately after delivery, but, on the following day, there was a violent inflammation of the parts, with a suppression of urine, and the lochia were discharged through the ruptured part, but no fæces ever came by the vagina. By the use of fomentations and cataplasms, of cooling laxative medicines, and occasionally of opiates, the inflammation was soon abated. The suppuration being profuse, the bark was given, and, at the end of ten weeks, the lacerated parts were healed."

In the cure of laceration of the perinæum there is no necessity to employ stitches; the parts heal by granulation and suppuration, and all that is required is to keep them in contact by placing the thighs together, at the same time bathing with saturnine solutions, or even with warm water. If the constitution is sound, the parts generally heal in seven or eight weeks, but on some occasions double this time is required.

It is wonderful how seldom laceration of the perinæum happens; but Nature has provided against the accident by causing the parts to dilate and accommodate themselves to the different stages of labour, and by the intervention of the sacro-sciatic ligaments, which yield and take off the pressure from the perinæum.

## SECTION II.

### DISEASES OF THE INTERNAL PARTS.

The diseases of the internal parts of generation in the female are more fatal than those of the external. The greatest number of them fall more immediately under the care of the accoucheur.

Those which most frequently require the interposition of the surgeon, are polypus and prolapsus uteri.

## POLYPUS UTERI.

Polypus of the uterus is a fungous excrescence, which may arise from any part of that viscus, but most commonly originates from the cervix. It has also been observed to spring from the vagina. Uterine polypi, like those situated in the nose, are of different degrees of consistence, and are sometimes attached by a slender pedicle, and sometimes by a broad base. These tumors are productive of considerable uterine irritation, attended by a discharge of an acrid sanies; and the patient is distressed with painful, profuse, and irregular hemorrhage, by which means she is frequently greatly reduced in strength before the real nature of the disease is discovered. This state is apt to be taken for menorrhagia. In our examination, care must be taken not to confound polypus with prolapsus uteri, which is a more common disease. The polypus has less sensibility than the uterus in its prolapsed state, and is generally of the shape of a pear, with the broad end downwards; whereas in prolapsus the small end of the tumor is downwards and the broad end upwards. In prolapsus we can distinguish the os uteri, and introduce a probe into it; but in the other tumor there is no opening perceptible. A probe can also be introduced by the side of a polypus, through the cervix uteri up to the fundus, but if passed by the side of a prolapsus it will be stopped at the upper part of the vagina.

It is imagined that polypus may be mistaken for inversion of the uterus, but this cannot happen if the surgeon is the least attentive in his investigations. Inversion of the uterus, when it protrudes from the vagina, no doubt presents to us a tumor resembling, in shape, the polypus, having the broad end downwards and the narrow one upwards, but it is easily distinguishable. The finger can be passed by the side of a polypus deep into the vagina, and the probe can be carried through the cervix into the cavity of the womb, but the surgeon can neither pass his finger nor the probe to any depth by the side of the inverted uterus. The root or basis of the inverted uterus feels soft and fleshy, while the root of the polypus is firm and hard. The history of the case also will enable the surgeon to trace inversion of the uterus to a difficult labour, or to an imprudent hasty extraction of the placenta.

Polypus of the uterus should be removed by the ligature. To effect this the patient should be placed on her back, and the surgeon having passed a strong ligature through the double canula, carries the noose upon the points of his fingers along the vagina, and over the tumor, till it embraces its roots, when he pushes forward the instrument, draws the ends of the ligature tight, and fastens them to the rings of the canula. The surgeon should endeavour to apply the ligature as near the root of the tumor as possible, but, if he cannot completely embrace the root, it is of little consequence, for when the tumor drops off, the root decays, and it has been observed that polypi of the uterus are not like nasàl polypi, very liable to be reproduced. In tying the ligature the surgeon should be careful to pull it sufficiently firm, so as to suppress hemorrhage, but not so tight as to occasion violent pain, as in this case it is apt to excite inflammation. Should the abdomen become tense and painful, or the patient be attacked with vomiting and hiccup, the ligature must instantly be cut out, and if it has separated much of the tumor, or if the base of the polypus be very narrow, perhaps he may then venture to remove it by excision. During its strangulation, the polypus swells, and sometimes compresses the rectum and neck of the bladder, so much as to prevent the evacuation of the fæces and urine. These inconveniences must be obviated by glysters and the occasional introduction of the catheter. The vagina should be washed out every three or four hours by means of a syringe, or glyster-bag and pipe, to prevent excoriation, which is apt to arise from the ichorous discharge increased by the action of the ligature. The polypus drops off generally by the fourth or fifth day.

In the first volume of Desault's Chirurgical Journal, is recorded a remarkable and interesting case of polypus, which was removed by ligature. The polypus was as large as the head of a new-born child, protruding from the vagina, and measuring at its base, above eleven inches in circumference, and three inches at its neck, or point of attachment. It was seven inches in length, of a pyriform shape, like a powder flask, with an unequal and tubercular surface, and of a scirrhous hardness.

## PROLAPSUS UTERI.

When the vagina is very much relaxed, the uterus descends so low down into it, that its orifice can be felt immediately within the os externum. This state is called prolapsus of the womb. When this affection continues long, the action of the abdominal muscles forces the uterus still farther down, till it at last protrudes externally. The disease is then termed procidentia uteri. It may be produced by long-continued fluor albus, or by whatever tends to relax the vagina. It frequently occurs in warm climates, in women who have borne many children, and is very apt to be produced by getting up too early after delivery, before the vagina has contracted sufficiently to support the enlarged womb. Prolapsus uteri is always attended with a bearing down in the lower part of the pelvis, with uneasiness about the loins and hips, and frequently with a discharge from the vagina. When the uterus has passed far into the vagina, the derangement of parts which it induces, and the tumor which it forms, prevent the discharge both of the fæces and urine.

If the prolapsus is recent, the womb should be immediately pushed up, a piece of sponge to support it, should be inserted into the vagina; the patient should be confined for a few days to the horizontal position, and a strong solution of alum, or other powerful astringent should be thrown up by means of a common glyster bag and pipe, or a womb syringe, five or six times a-day, always withdrawing the sponge, each time the liquid is injected. When the womb has descended so far as to protrude beyond the external orifice, and, when in consequence of stricture, formed by the sphincter vaginæ, of friction, and of flow of urine, it has become much inflamed and swollen, force should not be employed to reduce it, but recourse should be had to general blood-letting, the warm bath, warm fomentations, glysters, and rest, so that all inflammation may be allayed before any attempt is made at reduction. A practitioner is seldom called at the commencement of this disorder, as females conceal the complaint till they have long suffered under it.

In the greater number of cases which present themselves, the uterus can be easily returned on lying down, but the relaxation is so great, that when the patient resumes the upright posture, it immediately falls down again. In this state of the complaint, mechanical contrivances have been employed, and these are called pessaries. They are of various shapes, of a globular form, of the form of a ring, and of that of a pear, and they are made of boxwood, cork, elastic gum, and other light materials. The uterus is first reduced, and in order to support it, one or other of these pessaries is pushed up into the vagina. The ring pessary has generally been employed for married women, as allowing of the intercourse of the husband; but this instrument is apt to slip, and from its form, to cause ulceration; the globular one should, therefore, be preferred.

It must readily appear, that the use of pessaries, far from curing prolapsus uteri, must, by keeping the vagina dilated, perpetuate the complaint. The use of astringent injections seems, therefore, to be a practice preferable to the employment of pessaries. The female should be enjoined to take as little exercise as possible, frequently to recline in the horizontal posture, and every two or three hours, to throw into the vagina a solution of alum, of the sulphate of zinc, or a decoction of the quercus robur, or some other astringent. If the uterus falls easily down, or if the patient is in a rank of life which exposes her to much exercise, a piece of sponge should be inserted into the upper part of the vagina, which, by swelling with the moisture, will effectually support the womb.

# CHAPTER XXIV.

## AMPUTATION.

### GENERAL REMARKS ON AMPUTATION.

Amputation is more frequently performed than any of the other capital operations of surgery. As it requires little anatomical knowledge, it is often had recourse to unnecessarily, and many limbs are rashly removed which might be saved. But as, from the extent of wound, amputation must always be considered a dangerous operation, the surgeon should weigh the circumstances well in his mind before he ventures upon it, and remember that nothing can justify its adoption except the absolutely incurable nature of the disease, or the evident marks of the constitution sinking under its influence. The improved surgical treatment of aneurisms and wounded arteries, compound fractures, and diseased joints, has rendered amputation a much less frequent operation than it was forty years ago, but, as far as my observation goes, it is still too frequently performed. A surgeon must always feel a reluctance to perform amputation. When he cuts a stone out of the bladder, he can reflect on the operation with satisfaction, as he is sure that he has removed the source of a misery which imbittered existence, and from which his patient could not have been otherwise freed; whereas, when he amputates a limb, and his patient even survives the operation, not only does the mutilation remind the surgeon of the imperfection of his art, but he never can be certain that a recovery would not have taken place without such a sacrifice.

In the hands of the older surgeons, amputation was not only a rude but a very dangerous operation. They were unacquainted with the manner of preventing the effusion of blood by the tourniquet, and by tying the arteries; and they had no method of saving integuments to cover the bone. They seldom performed the operation; but when they did, it was generally on account of gangrene, and in this case they cut only amongst the dead parts. When they operated for other reasons, in order to prevent the effusion of blood during the operation, they compressed the limb by grasping it firmly with their hands, then cut down to the bone at one stroke, and closed the bleeding arteries by the actual cautery. Many of their patients died of hemorrhage, or of the constitutional irritation which followed the operation; and those who survived, recovered only after months of a painful confinement, attended by repeated exfoliations of bone, and a profuse discharge, which ruined the general health.

The two great modern improvements in surgery, and which are applicable to every capital operation, are the methods we employ for restraining the hemorrhage and saving integuments to cover the wounded surface, by which we effect a speedy cure. In no operation are these improvements more conspicuous than in amputation; and in them consists the sole superiority of the modern over the ancient operation. The first of them, namely, the restraining the hemorrhage, is effected by the use of the tourniquet and the ligature of the arteries; and the second, or the saving of integuments to cover the bone, by cutting the soft parts in such a manner as to form a flap, or by dividing the integuments and muscles by two distinct incisions. Of these two methods of amputation, one is termed that by the Flap, and the other Amputation by the Double Incision. Each of them has its advantages; but it appears to me, that, as a general operation, the double incision possesses a superiority over the flap amputation. I shall offer a few observations on each of these operations.

## AMPUTATION BY A FLAP.

Amputation is of two kinds, that of continuous bone, and that of the joints; and it may be performed, as we have observed, in two ways, either by a flap, or by the double incision. Lowdham, an English surgeon, in the year 1679, proposed to save in the leg as much muscle and skin as would effectually cover the bone, and thus prevent exfoliation, and hasten the cure. This was the origin of the flap amputation. In 1696 this operation was performed by Verduin at Amsterdam, and in 1702, by Sabourin at Geneva. At this time surgeons were cutting down to the bone at one stroke, and stemming the hemorrhage, by searing the arteries with hot irons; and it was imagined, that by forming a flap out of the soft parts, and clapping it down upon the bleeding vessels, it would stop the hemorrhage, save the necessity of taking up the arteries, and prevent the exfoliation of the bone. That the stemming the hemorrhage was a chief motive for their having recourse to a flap is evident, from this circumstance, that no notice is taken of securing the vessels by the surgeons of that time; indeed, Petit says, that amputation by a flap saves the necessity of tying the vessels.* Ravaton and Vermale, in 1739, proposed to make two flaps, and the latter of these surgeons transfixed the limb, and performed his operation in the same manner as Lisfranc and the French surgeons of the present day. Both Ravaton and Vermale secured the vessels by ligatures, and laid the flaps together for adhesion. Hence, the flap amputation in their hands was a very successful operation; but as surgeons did not, in general, secure the arteries, many of their patients died of hemorrhage. On this account the operation was forsaken, which was much to be regretted, as at that time they had no other means of forming a good stump, and insuring a speedy cure.

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* Il est certain que, par l'amputation à lambeaux, on abrége la guérison, parce que l'on évite l'exfoliation des os, l'application des stiptiques, et même la ligature des vaisseaux. Petit, Traité des Maladies Chirurgicales et des Opérations qui leur conviennent, tome iii. p. 137.

After the flap amputation had been abandoned for many years, it was revived by O'Halloran in 1765, and performed by Messrs. White and Bloomfield, as well as by several of the surgeons of that period. It must be remarked, that O'Halloran did not revive the flap amputation with a view to repress hemorrhage, but as the means of forming a good and useful stump, and he did not restrict the operation to the leg, but extended it to the thigh, the arm, and the fore-arm. Still, as O'Halloran and the other advocates for this operation did not immediately lay down the flaps for adhesion, but dressed the stump as an open sore, till suppuration was established, the constitutional irritation, from the extent of wound, was so great, that more patients died than in amputation by the circular incision. The operation was, therefore, again forsaken, and amputation by the double incision, which had been revived by Cheselden in England, and by Petit in France, was universally adopted.

Of late years the flap amputation has been again introduced in France, but the sole object, as far as I can perceive, for which the majority of its supporters employ it, is the stage effect resulting from the rapidity with which it can be performed. Amputation by the flap may be the superior operation when a limb is to be disarticulated, as it enables the surgeon to get more easy access to the joint. It is also preferable where the soft parts are much lacerated, as the flap can be formed out of the sound integuments; and, moreover, the operation may be advisably performed when the limb is small. Still, I maintain, that, as a general operation, amputation by the flap is attended with greater dangers than that by the double incision; and my reasons for this opinion may be shortly stated.

In amputation, the more extensive the surface of the wound, the greater will be the constitutional irritation; now, in the flap amputation, the extent of wound is always considerably greater than in that by the double incision, and this is particularly the case when the limb is bulky; besides, if the opposite surfaces do not adhere, the irritation will be much increased, and, consequently, the patient more in danger. Farther, when there is much muscular substance, and the surgeon forms his flap by cutting too horizontally outwards, the skin retracts with the muscles, and cannot, without difficulty, be brought to cover them. If this is the case, and the surgeon brings forward the skin and retains it by stitches, the muscular substance, not having room to swell, becomes, as it were, strangled, and the parts are liable to fall into gangrene. I admit, that amputation by the circular incision may take a longer time in performing than the flap amputation, but, it is certainly attended with less risk to the patient, and, when carefully and properly executed, the bone will be effectually covered, and as good and serviceable a stump obtained as after amputation by the flap.

## AMPUTATION BY THE DOUBLE INCISION.

Amputation by a flap was abandoned, chiefly in consequence of surgeons being disappointed in their expectations of suppressing the hemorrhage by pressing the flap down on the face of the stump, One of the chief defects in amputation, namely; that arising from the deficiency of soft parts to cover the bone, therefore, still remained; and as it was very desirable to obviate this defect, Cheselden in England, and about the same time, Petit in France, revived a method described by Celsus, which accomplished this purpose by simple and effectual means. This method of operating is what has been since called amputation by the double incision. It was performed by Garengeot, as well as by Heister, Le Dran, and Sharpe, and is the amputation which is now generally practised. Amputation, by the double incision, consists in making a circular incision through the skin and cellular substance down to the muscles, and dissecting these integuments back for two inches, more or less, in proportion to the bulk of the limb. A second circular incision is then carried through the muscles down to the bone, close by the base of the dissected integuments; and the muscles being separated from the bone for some extent, and powerfully retracted, the bone is to be sawn through. By this method of operating, the cut muscles project beyond the bone, and the integuments, being brought forward, cover the face of the stump. Messrs. Louis and Le Dran, surgeons of the first talent and observation, recommend in amputation of the thigh, to carry the external incision down through the superficial muscles, and after this first layer with the integuments is sufficiently retracted, to divide the deep-seated muscles, and then finish the amputation in the manner we have described. They conceived that by following this method, the bone would be better covered than when the first incision was carried merely through the integuments, and some surgeons adopt this plan; but I conceive, the whole face of the stump will be better covered by true skin, by separating the integuments from the muscles, than when they are divided together; as, in this case, the retraction of the muscles will carry back the integuments, so as not to permit the cut edges of the skin either to be brought, or to remain, so neatly in contact as when separated.

If amputation by the double incision be properly performed, a speedy cure will, in general, be effected, and a good stump formed, so that this may be deemed a perfect operation.

Amputation is generally practised on account of compound fractures, diseases of the joints, and ulcers of long duration, with diseased bones; but a variety of circumstances may call for the removal of a limb, such as extensive laceration, gangrene, tumors, &c.; and, I may here remark, that there is more difficulty in deciding when amputation should be had recourse to, than in performing the operation.

### GENERAL RULES FOR AMPUTATION.

The following directions are applicable to every kind of amputation.

1*st*, The first step in every amputation is to stop the flow of blood in the arteries, and this may be done either by the tourniquet, or by compressing the principal artery in the upper part of the limb. If the amputation is to be performed at a low point, the tourniquet should be employed, as being more secure than simple pressure, and as requiring for its management a less intelligent assistant; but, when the amputation is to be performed high, the tourniquet is not so eligible, as it embarrasses the operator, prevents the retraction of the integuments and muscles upon being divided, and hinders the surgeon from separating the soft parts from the bone so extensively as is requisite. In high amputations, therefore, simple compression is preferable to the tourniquet. The subclavian artery may be easily and effectually compressed, as it passes over the first rib above the clavicle, by pressure with the thumb of a strong assistant, or by what is preferable, the common tooth-key, having its claw removed, and its fulcrum padded by wrapping round it a strip of linen. In the lower extremity, the point of compression is the groin, and the artery may be commanded, as it passes under Poupart's ligament, by pressure against the pubis, either by a pad, or still better, by the thumbs, as they are not so apt as the pad to slip, upon any movement of the patient. The best mode of compression is to place one thumb obliquely above the other.

*2d*, When the amputation is to be performed in the arm, or in the thigh, the tourniquet should be placed high in the limb, because it does not then interfere with the operator, or prevent the retraction of the muscles on being divided. If the operation is to be performed at any point below the elbow or the knee; the tourniquet must be placed above these joints, because, if it were applied below them, the two bones would prevent the arteries from being compressed, and the flow of blood through them would not be obstructed. In the upper extremity, the tourniquet should be placed immediately above the elbow; and in the lower, a little more than a hand-breadth above the knee, so as to compress the artery against the bone as it passes through the triceps muscle.

*3d*, A circular compress about three inches in length, and about half an inch in diameter, is to be laid upon the principal artery, at the place where the tourniquet is to be applied. This compress, made of linen or cotton, should be pretty firm, but not rolled so hard as to prevent its yielding in some measure to the pressure of the tourniquet. It should be of a size proportioned to the bulk of the limb, and sewed to a strip of linen, which is to be carried round the limb, and fixed with a pin, but not pulled so tight as to obstruct the flow of blood in the artery, as in that case the vessels would not bleed when the tourniquet was unscrewed. An assistant should pull up the integuments before this bandage is tightened. A common roller having a portion of it undone, and the roll fastened with a pin, will serve for this circular compress.

4th, The ligature of the tourniquet is to be applied above the circular roller, and as the plate under the screw compresses more powerfully than any other part of the instrument, it should be placed over the principal artery when not inconvenient for the assistant, and the strap should be drawn so firmly as to require only one or two turns of the screw to stop the flow of blood, but not so tight as to check the circulation.

5th, Previously to the commencement of the external incision, the assistant should, by laying his hands upon the sides of the limb, and below the tourniquet, retract the skin; but, after the surgeon has begun to cut, no farther retraction should be employed till it is completely divided, otherwise the integuments will be cut irregularly. To effect the separation of the integuments from the muscles, all that is required, if the amputation is made at a healthy point, is to divide the bridles of cellular membrane while the assistant retracts; but, if the part at which the amputation is made has been the seat of inflammation, the adhesion will be so strong that it will be necessary fairly to dissect back the flap, keeping close to the tendinous sheath of the muscles.

6th, After the complete division of the soft parts, the muscles should be separated to some extent from the bone, and, previously to the employment of the saw, they should be retracted most powerfully. If this direction is attended to, the bone will always be well covered, and a fleshy and serviceable stump obtained. Linen retractors, which are commonly employed for this purpose, have not sufficient power, and metallic or leather ones should therefore be used. I have long been in the habit of using leather retractors, as recommended by Gooch and Broomfield, and find them answer well.

7th, In no amputation should the periosteum be scraped off the bone. This membrane can never impede the working of the saw, and its removal endangers exfoliation.

8th, Some art is required in sawing the bone, but the ease and neatness with which this can be effected, depend in a great measure on the assistant who supports the limb. In the commencement, the heel of the saw should be laid on the bone, and the instrument drawn along to its point; the blade should then be pushed along the groove it has formed, till it again arrives at the heel, and by continuing to carry the saw backwards and forwards the whole range of the blade, the bone will soon be divided. In sawing the bone, little force should be employed, the saw should be carried quickly and lightly along, and the assistant who supports the limb should be particularly attentive to keep it steady. If he raises it up during the sawing, the saw will be caught in the groove, and its working impeded; and if he drops the limb towards the conclusion, the bone will be splintered. He should pull the limb towards him, which will keep the groove free.

9th, After the amputation is finished, if any of the nerves are found projecting from the wound, the protruding portion should be cut off by scissars, otherwise it is in danger of becoming involved in the cicatrix, and producing great uneasiness, which may continue during life. This protrusion of the nerves may happen in any amputation, but it most commonly occurs at the shoulder joint and in the fore arm; and, after amputation at the latter place, I have known great distress arise from the radial and ulnar nerves being engaged in the cicatrix.

10th, In dressing the stump, the ligatures should not be brought out *en masse* at the upper and lower angles of the wound, as is commonly done, because in this case, acting as setons, they produce more suppuration; but each ligature should be brought out at a point opposite to the artery which it secures. This lessens the space the ligature has to traverse, makes it come more easy away, and renders the suppuration less extensive.

11th, The stump, in place of being loaded with dressings, should be lightly covered, which will not only permit of the more ready escape of effused blood, but will lessen the risk of suppuration, by keeping the stump cool.

12th, After the patient is laid in bed, the stump should be placed on a pillow; and, in order to prevent it from starting, it should be fixed down by means of a strip of linen. If there is much oozing of blood, it should be suppressed by the renewed application of cloths dipped in cold water; and if, on the second or third day, there should be much tendency to inflammation and swelling in the stump, it should be repressed by the same means, so as to procure adhesion if possible; but if the inflammation advances, and the tension becomes considerable, the plasters on the face of the stump should be loosened, and the bandages cut, so as to remove all stricture; a large warm emollient poultice should be applied, and renewed every three or four hours. This practice will establish suppuration early, limit its extent, and lessen the symptomatic fever; and when the febrile action has ceased, and suppuration been completely established, the edges of the wound are to be again brought together by plaster and bandage.

## AMPUTATION OF THE FINGERS.

The fingers may be removed either by cutting through the bone or by separation at the joints; and the operation may be performed in both of these situations by the flap or the circular incision. They are in general amputated at the joints, as being the more expeditious operation. The French surgeons prefer the flap amputation, and the English surgeons, in general, have recourse to the circular incision.

When the second or third phalanx is to be removed, the operation may be performed in the following manner. The patient is to be seated, and an assistant supports the hand, and bends all the fingers except the one to be amputated, so as to place them out of the way of the operator. The surgeon, with a scalpel, then makes a circular incision, about the third of an inch before the joint at which he means to remove the finger. This should be carried down to the tendons; and after it is accomplished, a longitudinal incision must be made on each side, commencing at the circular one, carrying it upwards, and terminating opposite to the joint. These incisions should incline rather towards the back than to the fore part of the finger, in order to pass behind the digital arteries which lie towards the fore part. The flaps are to be dissected back, after which, the finger being bent, one of the lateral ligaments is to be divided and the joint cut into, when the finger may be easily disjointed; and, by carrying the incision round through the tendons, capsular, and remaining lateral ligament, it will be readily removed. The flaps are now to be put in contact, and retained by a strip of adhesive plaster over the face of the stump, and another carried round the finger near its extremity. A piece of simple dressing is to be then applied, over which may be placed a bit of lint, and the whole is to be secured by a narrow roller fastened to the wrist, brought over the hand, and carried round the stump. In general, the digital arteries do not require to be secured by ligature, the bleeding being readily suppressed by the roller which is applied.

Lisfranc recommends to amputate the phalanges of the fingers at the second and third joints, by a flap formed on the anterior part. The operation is sooner done in this manner, but it requires more dexterity on the part of the operator, and the stump does not heal so readily when there is a single flap, as in the circular incision, where there are two, In performing this amputation, the patient being seated, the assistant places the hand in the prone position, which he supports while he bends the fingers, so as to prevent them from embarrassing the surgeon during the operation. The surgeon laying hold of the phalanx that is to be removed, places the finger in a semi-bent position, and by a full sweep of a straight bistoury, makes a transverse incision on the back part immediately before the fissure which is formed at the sides of the finger by bending it. This incision opens the joint, when the surgeon, by carrying the knife directly through it, divides the lateral ligaments and remaining part of the capsule. This being effected, he places his bistoury horizontally, and by bringing it forwards betwixt the integuments and the bone, forms a flap of such a size as he judges sufficient for covering it.

When the finger is so diseased that it cannot be bent, the hand is to be turned supine, and the flap formed by transfixing. The bistoury being placed laterally, its point is to be entered immediately before the fissure on the fore part of the joint, and pushed through betwixt the integuments and the bone. By bringing the knife forwards in this position, and cutting obliquely outwards, a flap is formed, which is to be held back by the assistant, when the surgeon, placing the edge of his knife upon the fore part of the joint, at one sweep separates the finger. The stump is to be dressed in the same manner as after the operation, by the circular incision.

When it is necessary to remove the finger at its junction with the metacarpal bone, the operation may be performed in one of two ways. In the first, the patient and surgeon should be seated, the hand to be operated on should be placed upon a table, and the fingers separated by an assistant from that which is to be the subject of operation. The surgeon then lays hold of the lower part of the first phalanx, and commences an incision over the upper part of the knuckle, which is to be carried down in a diverging direction by the side of the phalanx, till he arrives opposite to that point where the fingers unite. A similar incision, commencing at the same place as the first, is to be made on the opposite side of the joint, and carried down to the same extent. These two incisions resemble the letter A, and when they are completed, the hand must be turned supine, and by one stroke of the knife, the integuments and tendons on the fore part are to be divided transversely, so as to unite the two oblique incisions. The integuments are now to be dissected back on every side, so as to expose the joint, and after gently bending the finger, the lateral and capsular ligaments are to be divided, and the finger removed.

The second manner of amputating at the junction of the finger with the metacarpal bone, is that which is practised by Lisfranc; it is far more expeditious than the other, and the stump heals equally soon, as the operation leaves two flaps. The patient being seated, the hand placed prone, and the fingers held out of the way of the operator by an assistant, as already directed; the surgeon lays hold of the lower part of the first phalanx with the thumb and fore-finger of his left hand, and taking a bistoury in his right, places its heel on the upper part of the knuckle, corresponding with the finger to be removed. He now brings the knife obliquely downwards by the side of the finger, lowering his hand till he places the blade almost perpendicular; he then pushes it upwards and forwards, till he arrives opposite the joint, when, by directing the edge of the knife towards it, he divides the lateral ligament, and enters the capsule. By carrying the knife round the head of the bone, the phalanx will be easily separated, and by passing it betwixt the bone and the integuments, a flap will be formed so as to correspond with that of the opposite side. *

The stump is to be dressed, as has been already recommended, and if the digital arteries prove troublesome they should be secured by ligature.

## AMPUTATION AT THE METACARPUS.

Any of the metacarpal bones may be divided by cutting forceps or pliers, or by a metacarpal or chain-saw, or they may be removed at their junction with the carpus. The operation is easy when applied to the metacarpal bones of the thumb and little finger; but it is sometimes difficult to separate those of the fore, middle, and ring fingers, from their carpal connections.

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* In removing a whole finger, particularly the ring and middle fingers, both Dupuytren and Sir A. Cooper recommend the head of the metacarpal bone to be sawn off. The reason which they assign for this practice is, that the remaining fingers can be brought closer together, which not only lessens the deformity but renders them more useful.

When the amputation is to be performed at the junction of the metacarpal bone of the thumb with the trapezium, the patient is to be seated, and the hand placed supine if it be the right that is to be operated on, but prone if it be the left. The assistant now grasps the hand, and the surgeon lays hold of the thumb and separates it from the fore-finger. He then lays the edge of his bistoury on the middle of their connecting integuments and muscles, close by its heel, with its point directed perpendicularly upwards; then bringing the knife down, he now carries his incision betwixt the metacarpal bones of the thumb and fore-finger till he strikes the trapezium, when he directs the edge of the knife outwards, and cuts through the joint. After having carried the knife round the head of the bone, he keeps close to it, and brings the edge forwards, so as to form a flap of such an extent as he judges sufficient to cover the wounded surface.

When the little finger is to be removed with its metacarpal bone, the patient being seated, the hand placed prone, and supported by an assistant, the surgeon, after pulling the muscles and integuments towards the palm of the hand, runs his forefinger along the outer edge of the metacarpal bone till he feels the head by which it is connected with the carpus. He then places his left thumb upon the back of the bone, opposite to this point, after which he lets go the skin and muscles, so that they may return to their natural situation. Now, placing the forefinger of his left hand on the fore part of the joint, opposite his thumb, and after pinching up the skin and muscles, he enters the point of his bistoury perpendicularly downwards, and close by the outer side of the joint, so as to transfix the soft parts. He then brings the knife close along the whole length of the outer side of the bone, when he cuts outwards and forms a flap. The flap being held back by the assistant, so as completely to expose the joint, and the integuments being pulled over towards the thumb, the surgeon cuts into the joint from without inwards, and by carrying his knife through, and along the inner side of the bone, betwixt it and the metacarpal bone of the ring-finger, separates it from the hand.

When the metacarpal bones of the fore, middle, and ring fingers are to be separated from their carpal connections, the operation is as follows:—An assistant placing the hand prone, and supporting it in this situation, the surgeon, with a pointed scalpel, makes an incision through the integuments, along the whole length of the metacarpal bone, which is to be removed. He then turns the hand supine, and makes a similar incision along the anterior surface of the same bone. After these two incisions have been accomplished, the surgeon, by laying his fingers on one side of the hand, and his thumb on the other, is to pull the skin outwards, which will expose the inter-osseous muscles on one side of the bone, when, by carrying the knife betwixt the fingers up to the carpus, these muscles will be divided. The skin is now to be pulled inwards, so as to expose the muscles on the opposite side of the bone, and by a similar incision they also are to be divided, after which the joint is to be cut into on its anterior and posterior surfaces, and thebone re moved.

In all these operations, the tourniquet should be applied a little above the elbow, and the arteries should be secured by ligature, after which the wounded surfaces are to be placed in apposition, and retained by plaster and bandage.

## AMPUTATION AT THE CARPUS.

The patient being seated, and the tourniquet applied above the elbow, the hand is to be placed betwixt pronation and supination, and to be so held by one assistant, while another is to support the fore-arm and draw up the integuments at the wrist. The surgeon, standing on the outside of the arm, if the right hand is to be amputated, and on the inside, if the left, feels for the styloid process of the radius, and places his left thumb upon it; he then, with a catling commences his incision an inch before this point at the root of the thumb, and carries it in a circular direction through the skin and cellular substance; and after the circle has been completed, he dissects back the integuments as far as the styloid processes of the radius and ulna. The assistant keeps them retracted, and the surgeon placing himself before the patient, takes hold of his hand, and with the catling divides the lateral ligament connecting the radius with the carpus, and enters the edge of the knife in an oblique direction, betwixt the styloid process and the os scaphoides, into the cavity of the joint. By carrying the knife towards the ulna, he will easily effect the removal of the hand, and in this step of the operation, he divides the flexor and extensor tendons. In the separation he will be greatly assisted by bending the hand downwards.

If there are any projecting tendons or nerves, they should be cut short, after which the three arteries are to be taken up by the tenaculum, and secured by ligature, the edges of the integuments to be put in contact, and the stump dressed as after the amputations of the thigh and arm.

## AMPUTATION AT THE FORE-ARM.

The patient being seated in a chair, the tourniquet applied, and the fore-arm placed betwixt pronation and supination, one assistant supports the hand, and another the fore-arm, while the surgeon stands on the outside, if the amputation is to be performed in the right fore-arm, and on the inside if on the left, as directed in the amputation through the carpus. Matters being thus arranged, the assistant retracts the skin, and the surgeon with a catling, or small amputating knife, makes a circular incision through the skin and cellular substance down to the fascia. He then dissects back the integuments to the extent of an inch or more, in proportion to the size of the limb. The assistant keeps back the flap, and the surgeon again applying the edge of his knife at the base of the retracted integuments, makes another circular incision down to the bone. He passes the catling betwixt the bones, and freely separates from them the interosseous membrane and muscles. Linen or leather retractors, consisting of three tails, should now be applied, by means of which the soft parts are not only defended from the saw, but the retraction can be performed so effectually as to insure a good stump. The hand is now to be placed prone, and both bones sawn at one time, lightly and quickly, taking care, if possible, not to produce splinters. After tying the arteries, which are generally four in number, any portion of the radial and ulnar nerves which are observed to project, should be cut off with scissars, after which the edges of the wound are to be placed in contact, and retained by means of adhesive plasters, over which a piece of simple dressing is to be applied, and the whole very lightly covered.

The best situation for this amputation is about the middle of the fore-arm. The operation should not be practised very near the elbow, and it is observed that the stump heals more easily if effected at some distance from the wrist, so as to keep free of the tendons.

## AMPUTATION IN THE ARM.

In performing amputation above the elbow, it should be the aim of the operator to cut as low down as the nature of the accident or disease will permit, and more especially to amputate, if possible, below the insertion of the deltoid muscle, as the patient will then have a greater command over the stump. The patient is to be seated on a low chair, and the tourniquet to be applied at the upper part of the arm. The surgeon then places himself on the outside of the arm, if the right is to be amputated, but on the inside of the arm if the left is to be operated on, as being the most convenient position for dissecting back the integuments and muscles. One assistant, placing the arm horizontally, supports the elbow and fore-arm, while another grasps the arm and retracts the skin a little above the place where the first incision is to be made. The surgeon now, by means of a small amputating knife, makes a circular incision through the integuments down to the muscles. The integuments are to be dissected back to the extent of an inch and a half, or two inches, in proportion to the size of the arm, and after being held back by the assistant, the surgeon again applies his knife to the base of the reflected skin, and makes another circular incision through all the muscles down to the bone. The muscles are to be separated from the bone to a sufficient extent, after which the leather retractors are to be applied, and the soft parts powerfully retracted. The surgeon then makes a circular incision through the periosteum, as high as possible; in this line he places his saw, and divides the bone, taking care to avoid splinters, although the prevention of this occurrence must depend, in a great measure, as we have already observed, on the assistant who supports the limb. If the bone should be splintered, the rough points must be removed by the bone nippers, after which the humeral artery and its branches are to be tied, the edges of the wound brought together, and retained by adhesive straps, the usual dressings are to be applied, and secured by a roller.

## AMPUTATION AT THE SHOULDER JOINT.

Amputation at the shoulder joint may be performed with the utmost safety, as the subclavian artery can be easily and effectually secured by compressing it above the clavicle against the first rib. The operation may be performed in at least two ways, as by making a circular incision two inches below the joint, through the integuments and muscles, down to the bone, after which a longitudinal one is to be carried from the acromion process to meet the circular incision, then the flaps are to be dissected back, and the joint exposed and cut into; or it may be done by commencing at the acromion two incisions, carrying them down in a diverging direction, one inwards, and the other outwards, so as to resemble the letter A. The outward incision should terminate about three inches below the joint, on the outer side of the cord of vessels, and the inner incision on the opposite side, at an equal distance from it. The flaps are to be dissected back, the joint cut into, and the arm removed by a transverse incision joining the terminations of the oblique incisions.

But, as neither the circular nor oblique incisions give so ready an access to the joint as when it is uncovered by dissecting back the deltoid muscle, the amputation may be more easily performed in the following manner: The patient being seated on a low chair, the subclavian artery is to be compressed above the clavicle; which may be effectually done by means of a common tooth-key, having the claw removed, and the fulcrum padded; but if the surgeon should not have an intelligent assistant, I would recommend him to make a compress with a piece of dry sponge, of an oblong form, and firmly sewed up in shamoy leather. This compress is to be placed in the hollow above the clavicle, taking care that it be of such a size as to rise some way above the level of the bone. If an assistant then lays his expanded hand upon the shoulder, and presses firmly with his palm upon the sponge, the artery will be so effectually compressed, that, however unsteady the patient may be, the surgeon may proceed to his operation with perfect security.

The object of the operator should be to form a flap from the deltoid muscle and the integuments covering it. To accomplish this, an assistant supports the arm nearly at a right angle with the body, while the surgeon, with a large scalpel or small amputating knife, commences his incision at the top of the shoulder, and carries it along the arm on the outer edge of the deltoid muscle to the extent of three inches, keeping close to the bone. He then makes a similar incision on the inner edge of the muscle, after which he connects these two incisions at the lower part by one of a semilunar form, having its convexity downwards. The flap is now to be raised from the bone, commencing at the lower part, and dissecting upwards till the joint is uncovered. The flap being held up by an assistant, and the arm lowered a little by bringing the elbow towards the side, the surgeon makes a transverse incision across the top of the joint, cutting through the capsule and across the tendon of the biceps muscle. The assistant pulls down the arm, and the surgeon, carrying his knife in a circular direction round the head of the bone, divides at one stroke the remaining integuments, muscles, and capsule. After the limb has been removed, the axillary artery is to be first secured, and then the circumflex and other branches. The axillary artery may be taken up with the tenaculum, but it generally lies so exposed that it can be laid hold of with the finger and thumb, and a ligature put about it. After all the vessels have been secured, and the nerves cut short, so as to prevent them from being involved in the cicatrix, the edges of the wound are to be brought together, and retained either by suture or plasters, supported by compress and bandage.

If the surgeon is operating on account of a lacerated wound, he may not have it in his power to form a flap out of the deltoid muscle, but this is of little consequence. Integuments and muscle must be taken from that side on which they can be best procured, and his incisions formed in such a manner as to give the most effectual covering to the joint.

## AMPUTATION OF THE TOES.

The toes are to be amputated in the same manner as recommended for the fingers; and one or more of the metatarsal bones may be removed, when necessary, in the same way as directed for the removal of the bones of the metacarpus.

## AMPUTATION OF THE FOOT AT THE JUNCTION OF THE METATARSAL AND TARSAL BONES.

It will be recollected that the internal cuneiform bone, upon which the metatarsal bone of the great toe is implanted, projects about half an inch beyond the other tarsal bones, a circumstance to be kept in view when the metatarsus is to be removed at its junction with the tarsus. If this be neglected, the surgeon may have some difficulty in finding the joint, but he may divide the projecting portion of bone with the saw. In this amputation Lisfranc removes at the joints, and forms but one flap. He cuts across the dorsum of the foot, nearly on a line with the metatarsal joints, and takes the flap from the sole of the foot; while the English surgeons in general, after disjointing the smaller metatarsal bones, saw the internal cuneiform bone across, and form two flaps, one from the dorsum and the other from the sole of the foot. The operation with two flaps, as practised by the English surgeons, from its permitting the more ready healing of the stump, seems to be the preferable method. On one occasion, where I performed this operation on a child, in consequence of fracture of the first and second metatarsal bones, accompanied with extensive laceration produced by machinery, I formed the flap from the integuments on the dorsum of the foot, as those covering the sole were stripped off as far as the heel. From the extent of the laceration, and the nature of the injury, I could not procure integuments to cover completely the ends of the bones, but the wound healed rapidly, and the child was well in a short time.

Amputation of the foot at the junction of the metatarsal with the tarsal bones may be performed in the following manner: The patient reclining backwards, the leg is to be extended, and the heel supported by one hand of an assistant, while he lays his other hand across the dorsum of the foot, placing his thumb on the head of the metatarsal bone of the great toe, where it joins the internal cuneiform bone, and his fore-finger on the tuberosity of the metatarsal bone, at its junction with the os cuboides. The thumb and fore-finger of the assistant thus placed, serve as marks for the incision. The surgeon now, with a catling, commences an incision about half an inch before the thumb of the assistant, and carries it through the integuments across the dorsum of the foot, terminating about an inch before his finger. He then makes a longitudinal incision, to the extent of an inch, on each side of the foot, so as to enable him to dissect back the flap with freedom. As soon as he has dissected back the flap, and uncovered the joints by cutting through the extensor tendons and ligamentous fibres, he bends the toes downwards, and carrying the point of the catling into the joints betwixt the tarsal and the second, third, fourth, and fifth metatarsal bones in succession, effects their separation, when he saws the projecting portion of the internal cuneiform bone across. He now carries the knife round the joints, brings it forwards betwixt the lower surface of the metatarsal bones and the muscles covering them, and passing through the skin, cuts a flap out of the sole of the foot, of the same size as that which he has formed from the dorsum. The arteries are now to be secured by ligature, the upper and lower flaps to be brought into contact, and retained by two or three stitches of the interrupted suture and adhesive plaster, the whole being bound up with a compress and roller. It is necessary to mention, that in both of these operations a tourniquet should be applied a little above the knee, particularly if the patient be an adult and robust, as in this case there will be considerable bleeding from the external and internal plantar arteries, as well as from the anterior tibial.

## AMPUTATION THROUGH THE TARSUS BETWIXT THE ASTRAGALUS AND OS SCAPHOIDES, AND THE OS CALCIS AND CUBOIDES.

Amputation through the tarsus is more easily performed than that betwixt the tarsal and metatarsal bones; but the latter operation should always be preferred when circumstances will permit, as it leaves a more serviceable limb. The tourniquet being applied, and the patient placed in the same position as in the preceding operation, the assistant puts his thumb upon the projecting point of the os scaphoides, at the inner side of the foot, a little before the inner ancle, and his fore-finger on the outer side, opposite to his thumb, as marks for finding the joints betwixt the astragalus and os scaphoides, and betwixt the os calcis and os cuboides. The foot being held and supported in the palm of his hand, the surgeon makes an incision with a catling through the integuments across the dorsum of the foot, commencing an inch before the assistant's thumb, and terminating at a like distance before his finger. Two longitudinal incisions are now to be made, one on the inner and one on the outer edge of the foot, each about an inch in length, and extending from the transverse incision towards the ancle. The integuments are to be dissected back, and after cutting across the tendons on the fore part of the foot, the surgeon is to divide the ligaments connecting the astragalus and scaphoides, and the calcaneum and cuboides. This he does by commencing at the inner side of the foot, and carrying his knife across the dorsum to the outer edge. Now, bending the foot downwards, he carries his knife through the joints, and by bringing it forwards betwixt the bones and the muscles on the sole of the foot, cuts out a flap of such a size as he judges will be sufficient with the flap on the fore part to cover the bones.

The arteries are to be secured, the flaps retained by stitches, and the wound otherwise dressed as directed in the preceding operation.

## AMPUTATION BY A FLAP BELOW THE MIDDLE OF THE LEG.

When the disease or injury is confined to the foot or ancle, and it is wished to preserve as much of the leg as to enable the patient to use an artificial foot, the amputation may be performed in the lower part of the limb; and in this situation the preferable operation is that by a flap, as more effectually covering the bones, and forming a better stump. It was at this place the flap amputation was first performed. The tourniquet is to be applied immediately above the knee, and the leg extended and supported by two assistants, one grasping the limb a little above the seat of the amputation, and the other holding the foot and ancle. The surgeon then standing on the inner side of the leg, lays the palm of his left hand on its fore part, placing his thumb on the inner edge of the tibia, and his fingers on the outer edge of the fibula; he now passes a catling through the lower part of the brawn from within outwards, close behind the bones; and as soon as he has fairly transfixed the limb, he carries it downwards and outwards, forming a flap from the integuments and gastrocnemii muscles of such a size as will cover the ends of the bones. He then brings the knife across the forepart of the leg from the point at which it was entered, to that at which it passed out, so as to meet the flap at its base. By carrying the catling circularly through the muscles, and passing it betwixt the bones, the complete division of the soft parts will be effected, when they are to be held back by a linen retractor, the limb turned inwards, and the saw first applied to the tibia, and then to the fibula, so as to divide these bones at the same time. After the removal of the limb, the anterior and posterior tibial arteries, with the fibular, are to be secured by ligature, the flap to be brought over the bones, and retained by the interrupted suture with adhesive straps, and the usual dressings are to be applied.

## AMPUTATION BELOW THE KNEE.

When a surgeon has it in his power to remove a limb below the knee, this situation should always be preferred to amputation in the lower part of the thigh, for although in the former case, there is a less relative proportion of soft parts to cover the bone, still the patient not only runs less risk from the operation, but after his recovery has a better support for the stump, and possesses a greater command over the limb. When the amputation is performed in the thigh, we cut off the insertion of all the flexor and extensor muscles, and the limb is afterwards moved only by those which are implanted into the trochanters, and by the triceps; whereas, when the operation is performed below the knee, the insertions of the flexors and extensors being preserved, the patient moves his stump with more power, and is capable of undergoing more fatigue. Independently of this advantage, in using a wooden leg, the point of support being the upper and fore part of the tibia, all pressure and irritation is removed from the face of the stump.

In this amputation the patient is to be laid on his back, and the tourniquet being applied so as to compress the artery on the inner part of the thigh, as it passes through the triceps muscle, one assistant supports the lower part of the leg at a convenient height for the operator, while another embracing the limb with his hands, immediately below the knee, pulls up the integuments so as to put them on the stretch. The surgeon, then standing on the inside of the limb, with a catling or small amputating knife, commences his incision about six inches below the lower part of the patella upon the shin, and carries it through the skin and cellular substance round the leg so as to complete a circle. The integuments are now to be dissected back, to the extent of two inches, more or less, in proportion to the size of the limb, and being held in this situation, the surgeon places his knife at the base of the reflected integuments, and divides the muscles in a circular direction down to the bones. The catling is to be passed through the interosseous membrane, and by carrying it round the bones, all the fleshy fibres are to be divided so as to permit of the retraction of the muscles. The assistant now applies the retractors, with which he pulls up the soft parts, and the foot being turned in, so as to place the bones fair for the saw, the surgeon commences by sawing the tibia, and, after it has been partially divided, he also applies the instrument to the fibula, so as to divide both bones at the same time. The arteries are now to be secured by ligature, and care should be taken that this be properly effected. These vessels are apt to retract betwixt the bones, and be imperfectly tied, hence secondary hemorrhage occurs more frequently after this amputation than any other. After the vessels have been tied, the edges of the integuments are to be brought together in a perpendicular direction, and the stump dressed and bandaged as after the other amputations.

## AMPUTATION IN THE THIGH.

AMPUTATION is oftener performed in the thigh than in any other situation, as diseases of the knee-joint are a frequent motive for the operation. The amputation in the thigh is done in the same manner as in the arm; and, in performing it, the surgeon may stand either on the outside or on the inside of the limb, as best suits him; but he will find the outside the most convenient position when he amputates the right thigh, and the inside when operating on the left, as the parts then lie more fairly to his hand for the dissection. In this amputation, the patient is to be laid on his back upon a table, with his head and shoulders supported by pillows; his thigh is to be brought well over the edge of the table, and the tourniquet applied in the upper part of the limb near the groin. One assistant supports the leg at a convenient height, while another grasps the thigh with both his hands, so as to pull up the integuments. The surgeon, with the amputating knife, now commences his incision on the fore-part of the thigh, as low down as the nature of the disease or accident will permit, and carries it through the skin and cellular substance down to the muscles, and round the limb till he has completed the circle. When he has effected this, he separates the integuments from the muscles to the extent of two inches or more, in proportion to the bulk of the thigh. If the incision has been made at a healthy point, all that is necessary to effect this, is to divide the bridles of cellular substance with the large amputating knife, while the assistant pulls up the integuments; but, if the cellular membrane has previously been inflamed, it will require to be fairly dissected back, and in doing this he should exchange the amputation knife for the scalpel, as being a more convenient instrument. When the integuments have been separated to a sufficient extent from the muscles, they are to be held back by a linen retractor to guard them from being cut, and the surgeon, again applying his amputation knife at the base of the reflected integuments, makes another circular incision down through the muscles to the bone. He now, by means of a scalpel, separates the muscles from the bone fully to the extent of an inch, when the leather retractors are to be applied, and the parts powerfully retracted by the assistant. The scalpel is then to be carried round the bone close by the retractors, so as to divide the periosteum; and, by applying the saw in the line of incision, the bone is to be divided, the assistants and surgeon observing the general directions which have been already given, in order to avoid splinters. After the limb has been removed, the femoral and other arteries are to be secured by the tenaculum and ligature; a roller is to be passed round the body and brought along the thigh, so as to keep the muscles forwards over the bone; the edges of the cut teguments are then to be brought together in a perpendicular direction, and retained by adhesive straps; and the surface of the stump is to be covered with a pledget of simple ointment, and light compresses, and all is to be secured by the bandage.

The above is the most simple way of performing amputation in the thigh. It was the method practised and recommended by Mr. B. Bell, and which I have been long accustomed to perform. When properly executed, there will always be a sufficient covering for the bone, and it needs no particular art to perform it; whereas, in dividing the superficial and deep-seated muscles by distinct incisions, some dexterity is required to prevent the same muscle being cut twice, a circumstance to be avoided if possible.

## AMPUTATION IN THE THIGH BY TWO FLAPS.

In this amputation the patient is to be placed, the tourniquet to be applied, and the assistants to take their stations, as directed in the last operation. The surgeon stands on the outside of the limb, and grasps the inside of the thigh with his left hand, placing his thumb on the fore part of the bone, close to the point he means to transfix. He then takes a large catling or transfixing knife, and holding it perpendicularly, enters its point close by his thumb, and pushes it along in contact with the inner side of the bone, till he fairly transfixes the thigh, when, by bringing the edge of the knife forwards and cutting obliquely outwards, he forms a flap two or three inches in length, according to the bulk of the thigh. He again enters the knife at the same point where it was first passed, and carrying it on the outside of the bone, makes a flap equal in size to that which has been formed on the inner side. The flaps are now to be held aside by the assistant, and the surgeon, carrying his knife close by their base in a circular direction round the bone, divides any adhering muscular flesh, after which the saw is to be applied as high as possible. After the limb is removed, the femoral artery and branches of the profunda are to be secured by ligature, the flaps brought together, and the stump dressed as after the other amputations.

## AMPUTATION AT THE HIP JOINT.

Amputation at the hip joint must be viewed as the most dangerous operation in surgery, whether we regard the hemorrhage or the irritation necessarily arising from the extent of wound. I am aware that this operation has been several times performed with success; and in certain circumstances, such as in a thin or emaciated subject, it may succeed; but to amputate at the hip joint in a big and strong man, is to perform a hopeless operation.

When it is necessary to amputate at the hip joint, the method of performing it must be regulated according to the nature of the disease or accident for which we are to operate. Lisfranc recommends the operation to be performed by transfixing the limb and making two flaps; but I believe, that in the generality of cases, the preferable and least dangerous method is first to make a high circular amputation, and then to remove the head of the bone from the acetabulum.

In caries of the hip joint, arising from an internal cause, the acetabulum will be found to be as extensively diseased as the head of the femur; amputation therefore would be of no avail: and, in necrosis, an operation at the joint is not required, because in this disease it is only the shaft of the bone that is affected. The most common calls for amputation at the hip joint, are caries of the head of the thigh bone, with deep sinuses inducing wasting hectic; comminuted fracture; and extensive laceration of the soft parts, when complicated with a wound of the femoral artery, or fracture of the bone. In those cases I believe that after a high circular amputation, the bone may be readily removed by cutting into the capsule, laying hold of the diseased or fractured portion of bone with a blunt hook, and then dividing the round ligament with a curved probe-pointed bistoury; but, if this should be found to be impracticable, the object in view may be effectually attained by laying the patient on the sound side, making a longitudinal incision over the trochanter major, down to the face of the stump, and then separating the muscles from the bone, as recommended by my ingenious friend Dr. Veitch, late surgeon to the Royal Naval Hospital of Plymouth. When the injury or disease is confined to the soft parts, and the bone not affected, the joint should in no case be opened, as the constitutional irritation would thereby be greatly increased.

When amputation at the hip joint is performed, according to the method recommended by Lisfranc, the patient is to be laid upon his back on a firm table, his nates brought forward over its edge, and the limb supported by an assistant. The surgeon then feels for the anterior superior spinous process of the ilium, and from this point draws a line to the extent of an inch down the thigh. From the end of this line he draws another towards the pubis half an inch in length, and so as to form with the first a right angle. Upon the inner extremity of this line he places the forefinger of his left hand, as a mark where he is to transfix the limb. An assistant now compresses the artery as it passes under Poupart's ligament against the pubis, and the surgeon taking in his right hand a large catling or pointed knife, and holding it perpendicularly, enters it close by his finger, and pushes it down till it strikes the head of the os femoris, when, by inclining the handle inwards, he carries the knife on the outer side of the bone directly across the limb, till he fairly transfixes it by bringing the point of his knife out about an inch from the anus. He now, by directing the edge of the knife outwards, cuts in this direction about an inch, so as to clear the trochanter major; and then bringing his knife along the bone betwixt it and the muscles, and cutting outwards, forms a flap three or four inches in length. This incision will expose the femoral artery; and, for perfect security, the assistant should take it betwixt his finger and thumb, while the surgeon again enters his knife at the point the thigh was first transfixed, and by carrying it on the inner side of the bone, bringing it out at the place it was formerly passed, and cutting downwards, he forms a flap similar to the external one. An assistant now pulls the leg outwards, while the surgeon, with the point of his knife, divides the capsular ligament on its anterior and inner part, and at the same time cuts the round ligament, which permits the head of the bone to be turned out from the acetabulum, and the limb removed. The femoral artery and branches of the internal iliac are now to be secured by ligature—the flaps brought together, and retained by suture and plaster—and the wound dressed as after the other amputations.

Although the method of Lisfranc may be the more expeditious operation, still I believe the surgeon will be able to effect amputation at the hip joint, in the generality of cases that may require it, with more safety, by first making a circular amputation high in the limb, and then removing the head of the bone from the acetabulum. In this case the femoral artery should be compressed by an assistant against the pubis; and as soon as it is divided, it should be secured by ligature, which, by disengaging the hands of the assistant, will allow him to put his fingers on any arterial branches which may bleed. Every vessel should be tied, before the surgeon proceeds to open the capsule and remove the head of the bone.

FINIS.

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